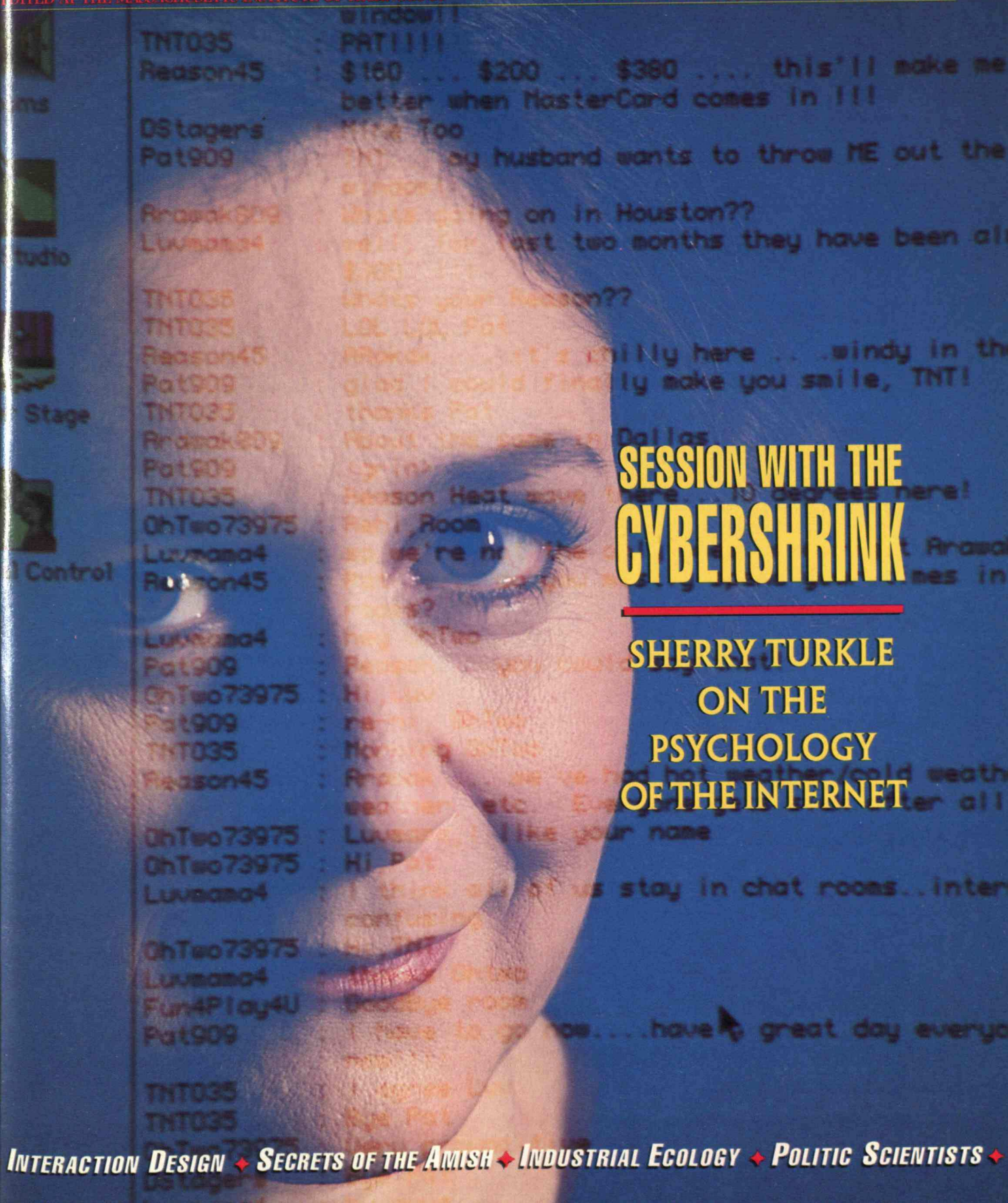


Technology Review

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FEBRUARY/MARCH 1996

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window!!
TNT035 : PAT!!!!
Reason45 : \$160 ... \$200 ... \$380 this'll make m
better when MasterCard comes in !!!
DStagers : Mine Too
Pat909 : TNT ... ay husband wants to throw ME out the
apartment!
Armad809 : What's going on in Houston??
Luvama4 : well, for last two months they have been all
\$1000 ...
TNT035 : What's your Reason??
TNT035 : LOL L/A Pat
Reason45 : Armad ... it's chilly here ... windy in the
Pat909 : glad I could finally make you smile, TNT!
TNT035 : thanks Pat
Armad809 : About the same in Dallas
Pat909 : Lololol
TNT035 : Reason Heat wave here ... 10 degrees here!
OhTwo73975 : Pat! Room
Luvama4 : so we're in the ...
Reason45 : Pat ...
Luvama4 : hey OhTwo
Pat909 : Reason ... you caught ...
OhTwo73975 : Hi Luv
Pat909 : re ...
TNT035 : Morning TNT!
Reason45 : Armad ... we've had hot weather/cold weath
weather, etc. Every ...
OhTwo73975 : Luvama4 I like your name
OhTwo73975 : Hi Pat
Luvama4 : I think all of us stay in chat rooms..inter
confusing
OhTwo73975 : Hi TNT
Luvama4 : Thanks TNT
Fun4Play4U : Goodbye room
Pat909 : I have to go now....have a great day everyo
TNT035 : ...
TNT035 : Bye Pat

SESSION WITH THE CYBERSHRINK

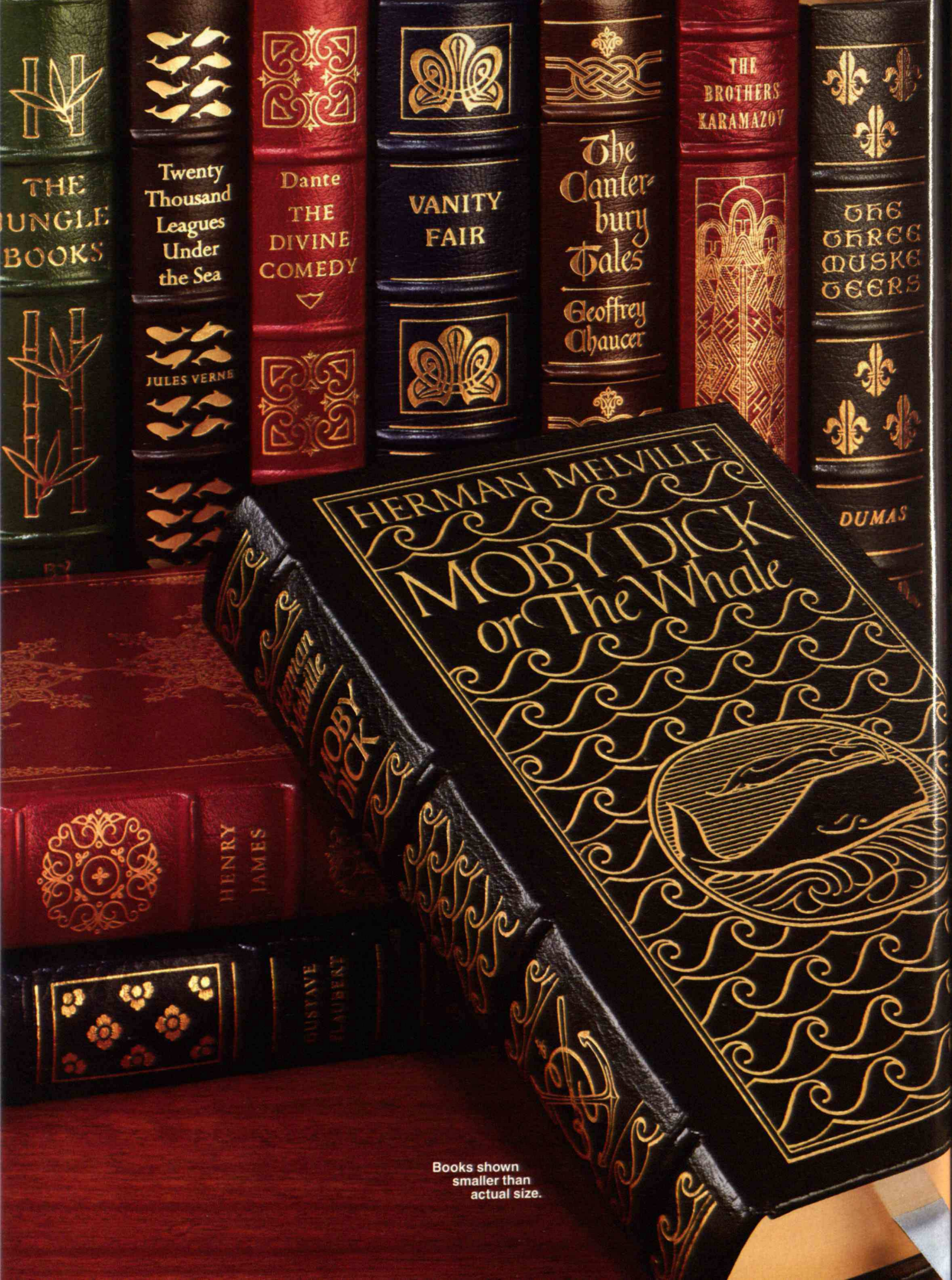
SHERRY TURKLE
ON THE
PSYCHOLOGY
OF THE INTERNET

INTERACTION DESIGN ♦ SECRETS OF THE AMISH ♦ INDUSTRIAL ECOLOGY ♦ POLITIC SCIENTISTS ♦

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
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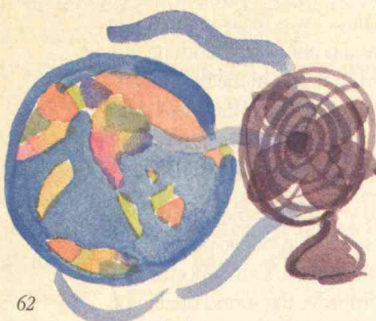


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First Line

MAGAZINES MEET THE ONLINE REVOLUTION

*Let's be nice to the kid.
When he grows up,
he may be our boss.*

My cousin Mel is a professional “liquidator”—or, as he likes to call himself, a “master merchant.” He acquires the physical assets of defunct businesses and then profitably resells them, either as products or raw materials, in other markets.

A few years ago he told me that he had just purchased a warehouse full of slide rules, some several hundred thousand of them. The “master merchant,” I sadly informed him, had been duped—the slide rule, traditionally an indispensable tool for engineers, had been rendered totally obsolete by the electronic calculator. “Oh, I knew that,” he replied. “I threw them all away. What I wanted was their leather cases.”

My colleagues throughout the publishing industry are openly worrying these days that another traditional tool—the print magazine—might suffer a similar fate. With the ascendancy of the Internet, and its potential for changing the world of journalism to one that is virtually all-electronic, we fantasize that our beloved and hard-earned products will one day retain only salvage value, say, for making wallboard or grocery bags.

At the recent American Magazine Conference, the event of the year for the business's leaders, this dominant concern was clear. In formal sessions and casual conversations alike, participants made constant reference to the perceived threat that the “online revolution” poses to conventional magazines. Commentators would then quickly follow up, in whistling-past-the-graveyard fashion, with reasons why cyberspace couldn't, wouldn't, shouldn't kill print. The World Wide Web serves sizzle, we serve steak. “Electronic publishing” (seemingly an oxymoron) is lightweight, while our stuff is serious. Print has “primacy,” asserted Tina Brown, editor of the *New Yorker*, while online is “an approximate world” that cannot match print's “complexity, sophistication, and staying power.”

Of course, online can do things that print cannot do so well, or at all. It can be a prodigious engine for information searching. It is not one-way, but interactive. And it is unsurpassed as a global communications medium permitting not only

low-cost conversations or transactions but the establishment of whole new social and professional networks.

All that is very promising and exciting. But why should it threaten print? Even the cyberspace aficionados concede that when you actually have to read something longer than a couple of paragraphs, nothing beats ink on paper. “The computer is remarkably clumsy for delivering prose,” Raymond W. Smith, chairman and CEO of the Bell Atlantic Corp., admitted at the magazine conference. “People turn to online not to read but to become part of a community.”

In that spirit, print magazines are increasingly establishing electronic presences. One can sample *Time* and the *Atlantic Monthly* on America Online, for example, or visit the *Technology Review* home page on the World Wide Web. By so doing, you can tap into some of the magazines' archives or converse with their staffs. But although these cyberspace versions provide some unique services, they are adjuncts to, not replacements of, our main business. Because print can't do the job of online, and online can't do the job of print, the two must coexist. Such complementarity satisfies the needs of the audience to alternatively read and reach out, each in their optimal domains.

That's true for the present. But what if cyberspace continues to expand and

mature so much that it eventually is capable of taking over areas, like much of print, previously considered sacrosanct? As playwright George S. Kaufman noted, children didn't bother him. He objected only that they grew up and crowded the subways. What if the Internet also grows up? If reading from a computer is currently clumsy, who says it can't become graceful, maybe even more convenient than print?

“Digital documents,” predicts computer-industry entrepreneur Bill Gates in his new book *The Road Ahead*, ultimately “won't even be fully printable on paper. They will be like a movie or a song is today.” Likewise, “incremental improvements in computer and screen technology will give us a lightweight, universal electronic book” that “will be able to help us in new ways.”

If such predictions indeed come to pass, they will clearly begin fulfilling some of print journalists' worst fears. But as spiritual leader Meher Baba used to advise, “Don't worry. Be happy.” Even in the extreme and unlikely case that print becomes utterly obsolete, the skills and standards behind magazines would not die with it. The new medium would still need to be replete with “software” types—people who do the actual journalism and deliver high-quality products. The same defenders of the language, crafters of intellectual beats, and explorers of policy issues, and their commitment to telling a good story and satisfying the audience, would be as crucial as ever. They would just be doing business in a new location.

So our task is not necessarily to hold onto a medium that's in the process of fading out—if that's in fact what is happening—but to be open to gradual and meaningful opportunities for applying our skills and pursuing our visions in ever more interesting, diverse, accessible, and useful ways. If my cousin Mel ever comes to purchase and resell *TR*'s stock of past issues simply for the paper, I hope I'll have long since stopped worrying. The concepts, talents, and materials the magazine embodies will ideally have been recycled to new and possibly more productive enterprises. ■

—STEVEN J. MARCUS

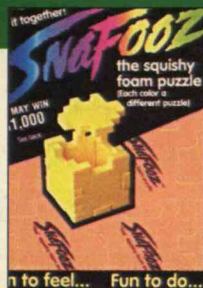
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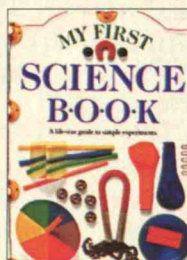
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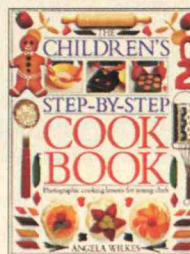


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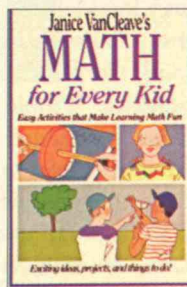


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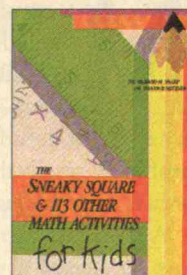


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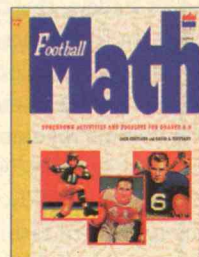
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Letters

DON'T DISCONNECT THE BRIGHT LIGHTS

In "The National Labs Unplugged?" (*Trends*, TR October 1995), Seth Shulman lumps the Department of Energy's weapons laboratories with the non-weapons multiprogram laboratories. The Brookhaven National Laboratory, which belongs in the latter category, was established after World War II by scientists from nine eastern universities (including MIT), not to build bombs but to create research tools for universities and industry that otherwise could not individually handle such projects.

Brookhaven has been remarkably successful in its mission. Eight scientists have received Nobel Prizes for work that was conducted in our facilities. The National Synchrotron Light Source, one of the most intense sources of x-rays and ultraviolet light in the world, attracts more than 2,300 users each year. The light source has enabled IBM and AT&T to develop x-ray lithography, Exxon and Mobil to study catalysts, and Du Pont to categorize chemical waste. MIT researchers have three beamlines for x-ray scattering studies at the light source. U.S. industries and universities have shown their support for Brookhaven by adding more than \$100 million dollars' worth of their own experimental equipment.

Shulman refers to the Galvin report's claims of "increasing overhead, poor morale, and gross inefficiencies" in the federal laboratory system." But by omitting the rest of the phrase, "... as a result of the overly prescriptive Congressional management and excessive oversight by the Department," Shulman leaves the impression that this statement was aimed at the laboratories. The Galvin report, far from criticizing Brookhaven, had high praise for the laboratory, as stated directly by Mr. Galvin to 300 users of the National Synchrotron Light Source at their annual meeting in 1995. Indeed, most of the report's barbs were directed at the DOE bureaucracy and not at the laboratories.

MARTIN BLUME
Deputy Director
Brookhaven National Laboratory
Upton, N.Y.

DIS-ORGANIZATION

Even more disturbing than the demise of "the organization man" that Langdon Winner discusses in "The Age of Expendability" (*TR August/September 1995*) is that this phenomenon has gone beyond the corporate world. Thus, institutions that were created to provide long-term vision, reflection, and guidance have been deemed expendable as well. An example is the recent closure of the Office of Technology Assessment, which was highly regarded not only in the United States but in other parts of the world.

Even here at the United Nations, fewer and fewer of us are part of an international civil service while more and more work is being done by short-term consultants. Although the reasons for this trend are manifold, political and financial pressures to deprofessionalize the U.N. under the pretext of inefficiency are obvious.

The long-term social costs of this trend surpass the suffering of individuals thrown out of their jobs and careers. A society where people no longer have a sense of belonging to an organization, and where there are no institutions to soundly analyze and guide political decision making, is unlikely to be a stable one.

DIETER KOENING
Division for Science and Technology
United Nations Conference on Trade
and Development
Geneva, Switzerland

FITTING IN THE POOR AT A PRICE

The opening to "Fitting the Poor into the Economy" (*Forum*, TR October 1995) is as eloquent a statement as I've read countering the general notion of the poor as undeserving and the specific notion that they are the cause of social and economic problems.

However, author Herbert J. Gans's suggestion that we discourage the development and use of labor-saving technology stopped me cold. Although some technology should be discouraged, I would not collectively label all labor-saving technology as bad. I doubt many peo-

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ple would be willing to forego technology such as indoor plumbing, central heating, telephones, and elevators. There are much better ways to distribute wealth more equitably than stifling technological innovation. One quick example is E.F. Schumacher's suggestion that no company pay any employee more than seven times the compensation of the lowest-paid employee.

WARD LARKIN
Houston, Tex.



Gans provides a succinct description and accurate analysis of the inconsistent—even hypocritical—treatment of the economic underclass and the collapsing middle class by the political and business establishment. But remarkably he stops short of recommending the simplest and most effective means of improving the economic prospects of all Americans except the wealthiest: totally eliminating immigration of all sorts. Do we have a surplus of workers? Then why does the United States allow torrents of immigrants to grab entry-level jobs? Is the middle class “sliding into poverty,” as Gans states? Then why are we abolishing one of the traditional paths of upward mobility, science and engineering, by welcoming waves of immigrating scientists and engineers?

ROGER A. LUCHETA
Johnston Island, USA

Gans is on the right track in identifying full employment as the most efficient antidote to poverty. However, semi-Luddite measures, such as replacing machine assembly of cars and appliances with hand assembly, seem unlikely to make much of a dent in the unemployment problem. After all, the “true” unemployment figure, including involuntary part-timers and those who have completely dropped out of the work force, is more than 16 million,

while the total number of blue-collar manufacturing jobs is only about 12 million.

Another one of Gans's proposals, shortening the work-week to 30 hours or less, is much more promising, since it would create jobs in both the service and manufacturing sectors. U.S. manufacturing wages, which are now more than 30 percent below those of other competitive countries such as Germany and Switzerland, could be increased proportionally to maintain take-home pay. Raising the age of mandatory schooling to 18 and reinstituting 65 as the usual retirement age would also create jobs for more working-age Americans.

Readers interested in exploring further the notion of creating jobs through reducing working hours can contact the Society for the Reduction of Human Labor, 1610 E. College St., Iowa City, Iowa, 52245.

PETER RINALDO
Briarcliff Manor, N.Y.

In laying out his vision for alleviating unemployment, Gans calls for New Deal make-work programs along with punitive taxes on labor-saving devices. He then warns that if these policies are not followed, government should ban labor-saving technologies altogether.

I understand how Ivy League sociology departments can turn out Luddite nonsense like this. What is beyond my comprehension is how *Technology Review* can see fit to print it. What would happen to society if, in the name of helping the poor, we declared a moratorium on brains and began modeling our economy on that of the Egyptian pharaohs?

WILLIAM A. FREZZA
Yardley, Pa.

CHARGING FOREIGN STUDENTS

Although Robert M. White makes a compelling argument about the dangers of “The Migration of Know-How” (*TR August/September 1995*), he alludes only faintly to government's role. From direct payments to state universities to large research grants for private colleges, the government indirectly subsidizes the education of thousands of foreign students who return to their native land with an advanced degree only to compete directly with U.S. companies.

White suggests that more U.S. undergraduates would pursue advanced engineering degrees if the government increased its funding for grants. The author has identified the right problem but offers the wrong solution. The alternative may be to charge foreign students full tuition. As it stands today, the U.S. higher education establishment, which is financed heavily by American taxpayers, is already an enormous mechanism for transferring wealth and knowledge to other countries. If foreign students are going to transport technological know-how out of this country, they should at least pay for their education.

ROBERT A. COMPTON
Indianapolis, Ind.

CALCULATING THE COSTS OF COMET BUSTING

In a Letter to the Editor (*TR July 1995*), Thomas Cusick criticizes Gregory Canavan's calculations regarding the expected losses from the impact of a large earth-crossing asteroid in “Comet Busters” (*TR February/March 1995*). But Cusick undermines his argument by proving that compound interest is a useful concept only when applied to tens—not hundreds and certainly not thousands—of years. He claims, “If we invested just \$1 today at 4 percent compound interest, it would grow to more than 250 times the estimated losses of \$400 trillion (arrived at by multiplying the world's current gross national product of \$20

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trillion per year by the presumed 20 years it might take to recover) in a mere 1,000 years." This notion is absurd. The world's GNP would not remain constant for 1,000 years, the losses that we would suffer 1,000 years from now would be vastly larger since the economy of the future would be much larger, and no actual investment fund could continue growing over such extended periods and at magnitudes exceeding the entire global economy.

RICH MICHALSKI
Frederick, Md.

Thomas Cusick erred in his application of the laws of probability when criticizing Gregory Canavan's calculations. In figuring the compound interest earned on an investment of \$1 while waiting for the next earth-crossing asteroid (ECA), Cusick incorrectly uses 500,000 years as the waiting time for the next impact. With ECAs colliding with the earth once every million years on average, the probability of an occurrence is one in a million for each and every year. Considering the gravity of the consequences, this probability is not that small.

To argue that we should defer any action to combat this risk because of the possibility that our descendants might be able to take more effective steps or do so more cheaply ignores the real possibility of a near-time disaster. If we could detect ECAs today, we might find out that one was on its way with an arrival date of less than 20 years. The cost of expanding our studies of ECAs and achieving a method of defense is small compared to the potential price of destruction.

ABRAHAM WEITZBERG
Potomac, Md.

INGENUITY≠MATHEMATICS

In "Everybody Counts" (TR August/September 1995), Dirk J. Struik attempts to equate the accomplishments of non-European mathematicians with those of their European counterparts by discussing artifacts and drawings that supposedly demonstrate mathematical thinking. But it is entirely possible to cre-

ate something without understanding the math that someone else may impute to it. A caption for

an illustration of Vanuatuan geometrical designs claims that their existence implies that "primitive cultures are capable of complex mathematics." More evidence is needed than the simple existence of these designs.

JEFF DIKE
Deering, N.H.

POTENT OMISSIONS

The introduction to "The Atomic Age at 50" (page 45, TR August/September 1995) describes the Hiroshima and Nagasaki bombs as "the second and third such devices ever built—the first (Trinity) was successfully tested." The uranium-based bomb used at Hiroshima was the first atomic bomb ever built while the plutonium-based one used at Nagasaki was the third one. Trinity, which was also a plutonium device, was the second such bomb ever built. In my opinion, it is important to keep the record straight because an untested device was used at Hiroshima.

Two different blueprints for atomic bomb construction, known as Thin Man and Fat Man, were being implemented simultaneously in 1944. Both required conventional high explosives for detonation, so even in the case of an



atomic dud, very costly nuclear parts would be destroyed. Although Thin Man was near completion, nonexplosive tests convinced scientists in April 1945 that a much smaller version of Thin Man could detonate the major nuclear explosion they hoped for and led the U.S. military to create Little Boy. On June 27, 1945, the military decided to ship the completed Little Boy, the

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first atomic bomb ever built, in pieces to the island of Tinian, where it would be assembled for an eventual attack.

Meanwhile, after theoretical study of the Fat Man configuration indicated that it might not explode as planned, full-scale tests were ordered. After a non-nuclear test bomb (the Chinese Copy) had been detonated with inconclusive results, Trinity was tested successfully in New Mexico on July 16, 1945. On August 6, 1945, Little Boy was detonated over Hiroshima, and three days later Fat Man exploded over Nagasaki. These distinctions were explained to me in the 1950s during a top secret lecture at the Ordnance School at the Aberdeen Proving Ground in Maryland. Following the declassification of the documents, Richard Rhodes provided full details to the public in *The Making of the Atomic Bomb* (MacMillan/Scribner, 1986).

DONALD SAYENGA
Bethlehem, Pa.

I deplore the unbalanced view John W. Dower presents in "Hiroshima, Nagasaki and the Politics of Memory" (*The Atomic Age at 50, TR August/September 1995*). Dower details the atomic bombings of Hiroshima and Nagasaki, but offers only a parenthetical remark on the atrocities inflicted by the Japanese on the Chinese and the Southeast Asians. More than 20 million people perished in China. In the sacking of Nanking alone, more than 200,000 people, many of them women and children, were massacred and countless numbers of women were raped. The savagery of the Japanese military is unsurpassed in modern history.

HUNG CHENG
Professor
Department of Mathematics
Massachusetts Institute of Technology

SAY IT WITH WORDS

I had to smile when I read "The Shadow of Your Smiley" (*Phenomena, TR October 1995*). Although I engage in a great deal of correspondence over the Internet and other online services, I

have not, nor will I ever, use something that, as David Brittan puts so well, resembles "a bobbing hula doll in the back of a Rolls-Royce." A discovery



that Thomas Jefferson and James Madison had exchanged smileys would redefine our birth as a nation. Just think what Shakespeare could have done with these little symbols. Emoticons can be summed up in one word—junk! They should be used only to see if the trash bin on one's computer desktop works.

JIM HUIDEKOPER
Jackson Hole, Wyo.

The presence of ugly emotion-conveying icons points to a problem more serious than the one Brittan describes. I'm afraid they're part of a superficial world in which laugh tracks and other cues try to tell us what is funny, serious, or otherwise significant. When I encounter a smiley, I assume that the writer didn't think the message was important enough to warrant clear writing.

DAVID HENKEL-WALLACE
Palo Alto, Calif.


IGNITING A SPARK

Congratulations to the author and designer of "Controlling the Immune System's Armies" (*Trends, TR August/September 1995*). After my nine-year-old son asked "what are these pictures all about?" we had a marvelous half-hour discussion on the subject. My son concluded, "Hey, this biotech stuff is really cool." Thanks. One never knows when a spark will be ignited.

MIKE LAIRD
Webster, N.Y.

MIT Reporter

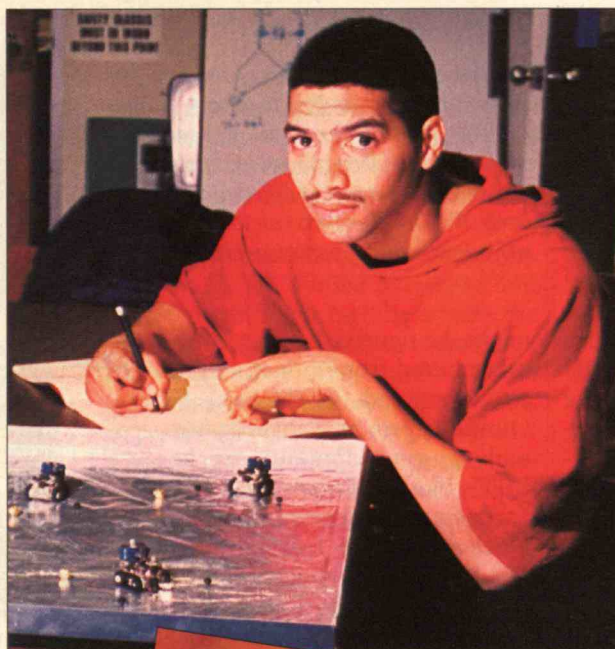
ROBOT ANT-ICS

 James McLurkin's work space is cluttered with items typical of a research scientist working at MIT's Artificial Intelligence Laboratory: transistors, circuit boards, and the like. But there's also the large Tupperware container that sits near his computer and houses his inspiration—ants. For the past three years, beginning while an undergraduate, McLurkin has been building a community of robots modeled after a colony of the social insects.

The notion has practical potential: cooperating robots could handle tasks that are best for people to avoid, such as removing bomb fragments from war zones and hazardous waste from landfills. But McLurkin has also been driven by a more basic desire—simply to develop a community of very small robots.

Each of McLurkin's dozen cubic-inch, 1.2-ounce robotic ants is packed with gizmos. These include 17 sensors that allow each robot to recognize aspects of its environment, such as the location of other "ants" through "bump" sensors that resemble and act like whiskers. Moreover, two devices emit infrared (IR) signals—which can be sensed by other robots—while three "actuator" devices enable the machines to manipulate their surroundings. (For instance, a pair of "mandibles" can grasp items.) Also squeezed in with the requisite computer chip and a battery are two motors that enable each robot to move six inches a second on two treads plus a third motor that powers its mandibles.

All these mechanisms enable the robots to interact in a way that begins to mimic a true ant community. Consider, for instance, how McLurkin has programmed his machines to forage for "food," which consists of quarter-inch brass balls. When a machine's bump sensors, which carry a voltage, encounter brass, the resulting conductivity causes the robot to emit an IR signal. During a



James McLurkin's robots, designed to interact like ants in a colony, are crammed with numerous sensors and three monitors as well as a computer chip and a battery.

"foraging" period, the reception of that signal by the other machines is an indication that "food" has been found. Those robots then follow the signal to join the first machine.

To make the foraging activity better approximate what happens in nature, McLurkin intends to simulate the scent trail that real ants leave between food and their colony's nest. Robots that find brass balls might leave an ink trail that their cohort could detect with an appropriate optical sensor.

An important aspect of foraging and the other activities McLurkin is devising for his robots is the community's ability to succeed at a task even if one individual fails—as in the style of natural ant colonies. Because success stems partly from the sheer number of working robots, the more machines he develops, the more often his colony will complete its tasks. The researcher is going for a total of 21 machines, which would make the robot community one of the largest in the world.

Another key to the robots' ability to work together smoothly lies in devising programs that are as simple as possible,

according to McLurkin. Traditionally, programmers have written large, complicated robotic codes that process every sensory input before giving instructions on how to respond. Such complex programs are difficult to write and operate. By contrast, McLurkin designs numerous small programs that run concurrently and that each focus on only one or two possible inputs. Depending on the actual inputs, only the program deemed most appropriate by the programmer directs the robot's response. The programming technique, called subsumption architecture and developed by Rodney Brooks, professor of computer science at MIT and associate director of the Artificial Intelligence Lab, creates "complicated-looking behavior from simple instructions," McLurkin says.

For example, when his "ants" engage in a programmed game of tag, a robot that is not "it" typically starts by moving forward slowly, based on a program directing that action. A second program enables the robot to move away from objects into which it bumps. A third program enables the machine to note when it is tagged—through the transmission of an IR signal—by the robot that is "it." When tagging occurs, other programs direct the robot that is now "it" to move

forward slowly and emit an IR signal upon bumping into an object.

Such interactive abilities have attracted the attention of the U.S. Central Intelligence Agency, which has expressed initial interest in miniature robots that could conduct a surveillance operation by carrying a group of cameras and microphones. And the Department of Defense (DOD) is funding McLurkin's research on foraging because DOD experts see possibilities for directing robots with mandibles to retrieve fragments of cluster bombs, a task now performed by people.

But before robot communities can move into the commercial mainstream, says Maja Mataric, an associate professor of computer science at Brandeis University whose doctoral work at MIT on robotic communities inspired McLurkin, researchers like him must develop better sensors and actuators. For example, the ability to develop a relatively small sensor that can sniff out many chemicals is important, according to McLurkin, who points out that "if we packed all the different chemical sensors into a robot now, it would be the size of a refrigerator."

While resolving such problems could lead to practical applications of significant social value, McLurkin also envisions some possible "lighter-weight" uses for the machines. A group of micro-robots could reside under a refrigerator during the day and pick up crumbs on the floor at night, he proposes, or could be marketed as a game-playing toy that "would be cool for kids."

—STEPHANIE V. GREPO

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NUCLEAR-AGE SLEUTHING



In 1989 Ilhan Olmez learned of a set of ice cores drilled from Antarctica's frozen depths. An expert in analyzing trace amounts of elements, he thought that such "cylinders"—whose vertical layers record what fell on the ice in past years—could tell a story. They

Ilhan Olmez collects samples of airborne matter in order to analyze their constituents. His group irradiates each sample, whose elements then convert to isotopes that emit gamma rays of different energy levels. With these, experts can identify varying amounts of particular elements.

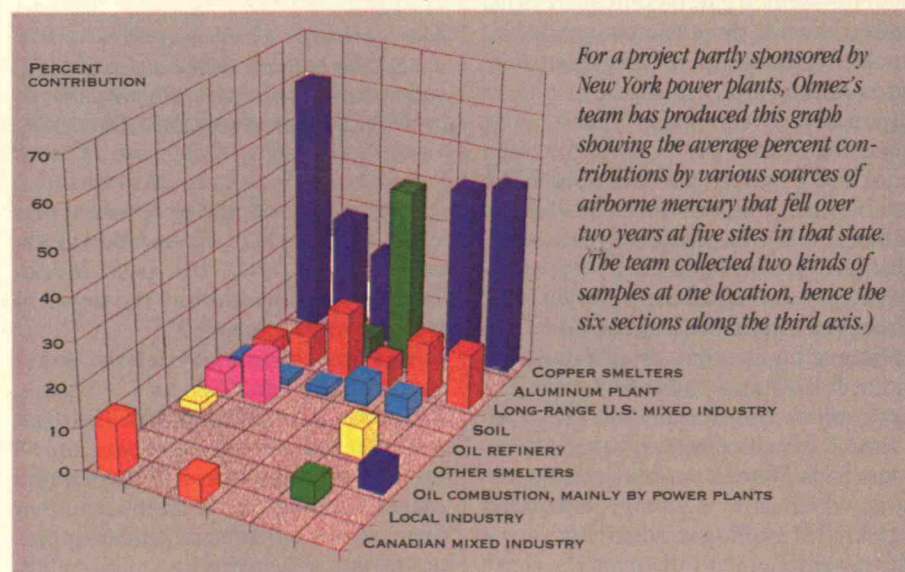
might, he figured, contain chemicals emitted from industrial processes thousands of miles away. So Olmez, a principal investigator with a joint appointment in MIT's Nuclear Engineering Department and interdepartmental Nuclear Reactor Laboratory, and his group examined 554-foot-long ice cores—representing more than 600 years of buildup—using a nuclear-bombardment technique that can identify elements by sensing high-energy radiation that they then emit.

The work—analyzing elements back to 1939 in one-year intervals, and back to 1711 in five-year intervals—was "very, very tedious," says Olmez, and did not indicate industrial contamination. But the group did find occasional peaks of sodium and chlorine, the elements that make up common salt. What could be going on? After he exhorted his



troops to check out various possibilities, the team uncovered a link—El Niño, the occasional shift in Pacific Ocean temperature and wind patterns that causes climate problems worldwide. At least as far back as the group could find records of the phenomenon, El Niño occurred within a year or two of the periods marked by sodium and chlorine peaks.

And so, in a paper Olmez has been writing, he contends that sodium and



chlorine concentrations in Antarctic ice could serve as historical markers of El Niño. (He suggests that, in part, El Niño's rising temperatures over the southern Pacific cause more oceanic salt to volatilize and then fall over Antarctica.) A lengthy record of the phenomenon could give scientists a better sense of the range of time that could occur between future El Niño events, says Mark A. Cane, senior scientist at Columbia University's Lamont-Doherty Earth Observatory.

Don't Breathe on the Samples

While other researchers need to examine the proposal—Cane notes that many El Niño "markers" have come and gone—the story shows the kind of far-flung connections commonly made by Olmez.

They almost all relate to his use of neutron activation analysis (NAA), a technique employed by only a handful of experts for determining the composition and amounts of elements in a material sample.

Inside a nineteenth-century brick complex that once housed a bakery and cheese plant, team members start the NAA procedure by placing a sample in a clean container. They carefully avoid contaminating the material, since NAA is so powerful it will detect a trace of gold if a person with a gold filling breathes once onto the sample. Next the researchers send it through pneumatic tubing to a 5-megawatt reactor some 350 feet away, then irradiate the material with neutrons. That causes each of many elements in the item to convert to a radioactive isotope that, as it decays, emits a particular type

of gamma ray. A sensor identifies the energy level associated with each type and determines the intensity of each energy level. An attached computer then produces a graph showing numerous peaks associated with a variety of gamma-ray energy levels—information that experts immediately interpret as varying amounts of particular elements.

The results can indicate quantities as small as a picogram—a million times smaller than one part per million (ppm). Such sensitivity is important in determining levels of some air pollutants, such as mercury. If one picogram of atmospheric mercury routinely falls onto the surface area of say, a lake or stream, algae will initially absorb the mercury and concentrations will increase with movement up the food chain until the amount of mercury in large fish in that

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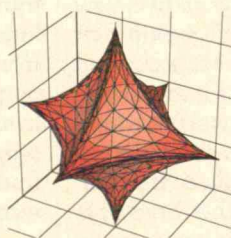
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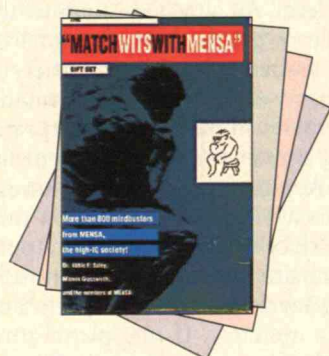
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† Wester, M., *Computer Algebra Netherlands*, Dec. 1994. Available by ftp at math.unm.edu/pub/cas/Paper.ps. Numerical scores are derived by assigning ±1, ±, 0 for correct/incorrect, partially correct/incorrect, and no answer.

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water will concentrate to 1 ppm. The U.S. Environmental Protection Agency (EPA) bans human consumption of fish with 1 ppm mercury because of the possibility of nerve and brain damage.

Olmez has therefore been using NAA to identify the quantities and sources of atmospheric levels of mercury and several dozen other trace elements for a project sponsored by the Empire State Electric Energy Research Corp. (ESEERCO) and the New York Department of Environmental Conservation. The New York power plants want to determine how much of the region's airborne pollutants come from long-distance and local sources and from natural and industrial sources. In accord with the 1990 Clean Air Act amendments, EPA has just finished studying hazardous air pollutants coming from utility boilers, information that might lead to new regulations. In part, the project Olmez has been working on could help the utilities respond to EPA proposals.

Finding Pollution Sources

Using teflon filters and tubes of activated charcoal—a material commonly used to absorb undesirable compounds in tap water—placed on the sides of five New York mountains, Olmez's group first analyzed how much of each element wafted down daily. Most interested in the sources related to the worst contamination days, the group then focused on the dates when levels spiked. It examined wind patterns for the three days before each spike—the longest period for which wind patterns can be reliably connected to local events—and chemical “signatures” that Olmez and other researchers had previously associated with emissions by different kinds of manufacturing and power plants.

One finding was that, according to Olmez, a “significant portion of the observed concentrations” of airborne mercury comes from outside the area—largely from Canadian copper smelters and the Midwest. Olmez says these sources appear to have “a general influence in the northeastern United States.”

This conclusion could be contentious, points out Sandra Meier, administrator of toxics and water quality programs for ESEERCO.

While scientific peers of Olmez review the results, he's busy with other work. For instance, he's in the midst of using NAA to determine the chemical compositions and origins of atmospheric particles collected as they fell onto mountaintops in Great Smoky Mountains National Park this past summer. The haze for which the area is named has been worsening, and the Electric Power Research Institute of Palo Alto, Calif., and the U.S. National Park Service have teamed up to analyze whether particles from industrial sources are adding to the problem. Olmez is trying to identify extremely small concentrations of elements that may serve as signatures for the particles' sources.

Over the years, Olmez's experience with NAA and nuclear science has led him from one research field to another. In the output from catalytic converters he has found rare-earth elements—lanthanum and cerium—that, because they remain in the soil or wherever else they fall, could help researchers estimate how much motor-vehicle exhaust is contributing to smog and other forms of pollution in specific urban areas. (The lead from leaded gasoline used to serve this purpose.) He has looked for radioactivity in samples of materials that traveled in space six years on a satellite's covering, finding that the levels of radioactivity were too low to endanger human health or the functioning of computers on board the spacecraft. He has even testified in murder cases about his knowledge of trace elements, since tiny amounts of the chemicals that start the combustion process involved in shooting a gun can stay for six hours on a hand that fired the instrument. Olmez “has a reputation” for busying himself with “a million activities at one time,” says David L. Anderson, a U.S. Food and Drug Administration chemist who also conducts NAA research. “If he sees a scientific angle on something new, he doesn't hesitate.”—LAURA VAN DAM

Trends

Videoconferencing for the Rest of Us

The four-year-old boy was climbing on the couch in his home when an adult voice gently urged him to stop. Neither of the child's parents were in the room; the suggestion came instead from the audio speakers of his family's computer. But this was no virtual babysitter talking—rather just a family friend halfway around the world in Australia conversing with the boy through an open videoconferencing link.

Welcome to the world of CU-SeeMe, a simple and inexpensive approach to desktop videoconferencing developed at Cornell University. Since its initial release in 1992, the software has enabled Internet users to see and talk to each other—in essence to conduct video phone conversations on their personal computers.

Until recently, videoconferencing had been the province of dedicated systems housed in special-purpose viewing rooms. But since the development of software packages such as CU-SeeMe, desktop videoconferencing has become more widely accessible through networked personal computers.

By distributing CU-SeeMe over the Internet free of charge, Cornell researchers hope to stimulate the growth of videoconferencing and use the resulting field experience to improve the technology. "The value of communications technology is proportional to the number of people who have it," points out Tim Dorsey, a computer analyst at Cornell who developed the Macintosh version of CU-SeeMe. "We're trying to create critical mass."

The approach appears to be working. Dorsey estimates the number of users worldwide to be at least several tens of thousands. The diverse community, he says, includes university researchers, scientists at remote work sites, medical practitioners, students, museum curators, astronauts in space, friends avoiding the cost of long-distance telephone

With Cornell's free CU-SeeMe software and a low-cost video camera, personal-computer users can dial into videoconferences on the Internet. The caller's screen shows black-and-white video images of variable quality of up to eight participants and lists the names of others connected to the conference. To join the conversation, a caller must first press the talk button before speaking into the computer's microphone, as if using a CB radio.

calls, and even journalists conducting interviews.

Price alone accounts for much of this popularity. Other than a video camera, which is available for as little as \$100, all one needs is a computer with either a Macintosh or Microsoft Windows operating system, a monitor displaying at least 16 levels of gray, and Internet access through a modem or other connection with at least 28.8 kilobits-per-second capacity. (CU-SeeMe software can be downloaded from the Internet at <http://cu-seeme.cornell.edu> or <ftp://cu-seeme.cornell.edu/pub/video>.)

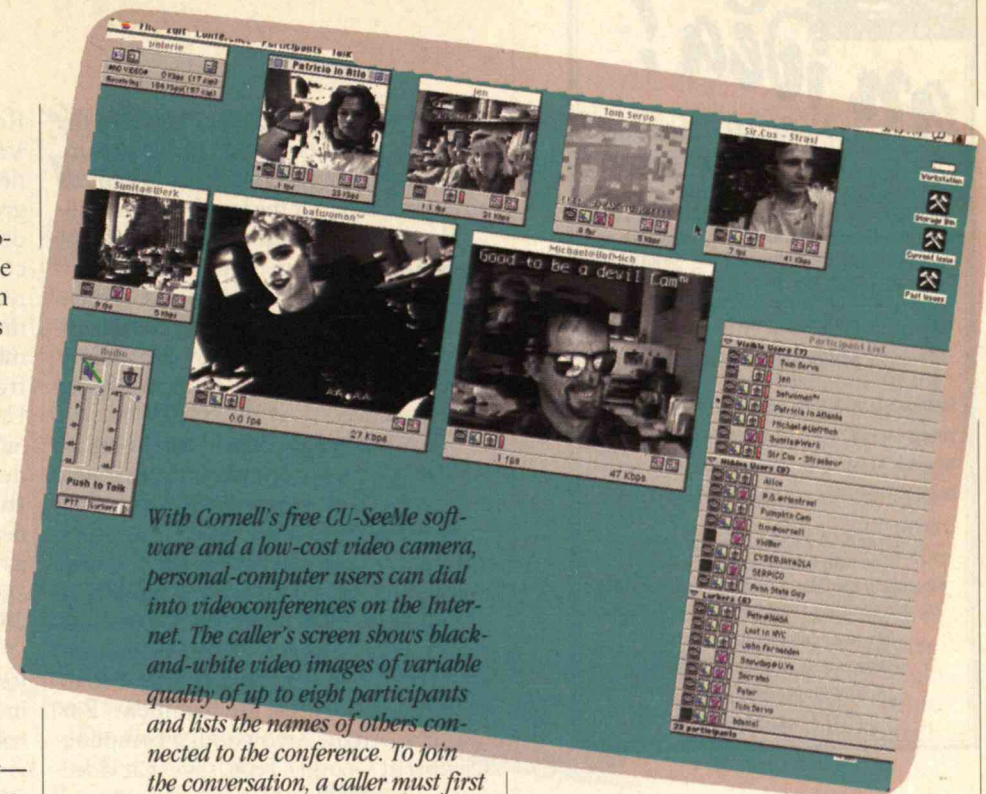
Once equipped, CU-SeeMe users can exchange video and audio transmissions either person-to-person or in group conferences. In the latter case, users must dial into a "reflector" site housed on a Unix computer. A reflector does just what its name suggests, accepting transmissions from individual users and distributing them to all the members of the group. The number of callers that can be connected depends on the bandwidth avail-

able to a given reflector system.

Cornell's high-bandwidth T-3 telephone lines carry 45 megabits of information per second and can accept up to 25 callers at a time, says Dorsey. But many other reflector sites, with older T-1 lines, can connect only around a dozen at once.

When an individual establishes a videoconferencing link by dialing an Internet protocol number, black-and-white video windows of up to eight other users can pop up at once on the caller's screen. The program randomly selects which participants to show in the windows, but the user can change the selections from a menu of conference participants. Users normally train their cameras on themselves but sometimes show closeup views of photographs, scenery outside office windows, or even special events such as musical performances.

Program developers have included a "talk window" in the program that allows users to type comments or questions in a text box that carries a running transcript at the base of the video window. This feature compensates for the notoriously poor quality of audio on the Internet, where data packets can get



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delayed or lost because they all share the same congested electronic traffic stream. In contrast, telephone callers are allotted an entire circuit for the length of each call.

"Lurkers" without video cameras can also participate in conversations by speaking through microphones in their personal computers or typing comments into talk windows. Or they can simply look and listen without acknowledging their presence.

Not surprisingly, many early uses of CU-SeeMe have been playful, personal, and unfocused. Dorcey speculates that most CU-SeeMe videoconferences probably entail calls between friends and loved ones or the flirtatious bantering of young people connected to the same reflector site. Other CU-SeeMe enthusiasts report that they use desktop video to enhance their office environment. For instance, Adam Arrowood, a computer scientist at Georgia Tech, says that video images on CU-SeeMe provide a "window on the world" in his basement office. Merlin Fahey, a multimedia research technologist at the City University of New York, often keeps CU-SeeMe audio playing on his computer, like background music on a desk radio.

But applications are growing for work and education as well. For example, earthbound spacewatchers have been able to view live video recordings of crews at work on Space Shuttle flights and tune in to NASA's reflector-based TV channel. A recent project at Tufts University allowed artists to transmit images of their work to a remote audience using a videoconferencing link. Scientists stationed in Antarctica have stayed in contact with friends, relatives, and work associates through CU-SeeMe videoconferences. And universities such as Dartmouth are developing computer-based video for remote medical diagnoses to enhance rural health-care delivery.

Students from approximately 40 elementary and secondary schools are now incorporating videoconferencing into classrooms. For example, a grant from the National Science Foundation to support the Global Schoolhouse Project has enabled language and science classes at

Rocky Run Middle School in Chantilly, Va., to use CU-SeeMe. One class practices Spanish language skills by helping a group of professors and graduate students from Barcelona test a multimedia computer game. Another class has received textual references and graphics materials for reports on rainforest medicines and other scientific topics from medical faculty members at the University of Otago in New Zealand. School librarian Sandra Todd thinks desktop videoconferencing is helping students improve their personal confidence and conversational abilities as well as their research skills. "It's the most exciting thing I've seen in education in 25 years," she says.

Advocates of CU-SeeMe reel off a long list of other possible applications, including customer service on product help lines, remote control of machinery, virtual museum tours, maintaining closer ties between widely dispersed members of ethnic groups, teacher-student conferences, and allowing drivers to view traffic patterns during their daily commutes.

Bandwidth Limitations

But despite the technology's promise, all observers agree CU-SeeMe still has major shortcomings, not the least of which is the quality of its video image. Rather than displaying the full-color images everyone is accustomed to seeing on TV, for instance, CU-SeeMe transmits only black-and-white pictures that move slowly and jerkily because of the limited bandwidth available on many phone lines. Video quality is expected to improve as more telephone companies offer higher-bandwidth Integrated Services Digital Network (ISDN) lines and asynchronous transfer mode (ATM) switches, which allow fast distribution of large amounts of data.

Other problems with CU-SeeMe include the awkwardness the system imposes on the flow of conversation. Instead of being able to interject comments at any point, users must operate in either the send or receive modes, like CB operators. Moreover, the technology

lacks security. Just as thieves can "sniff" packets of information carrying credit-card numbers in electronic data streams, so too can they capture and view CU-SeeMe transmissions intended for other eyes. Finally, the CU-SeeMe experience can occasionally be bruising. While the flaming that occurs on electronic mail does not appear common (perhaps because most encounters are face to face), visitors to some reflector sites may be subjected to sexually suggestive conversation and images.

Future versions of CU-SeeMe will address many of the system's technical limitations. Cornell is continuing to distribute CU-SeeMe as free software, but an enhanced version is being created by Cornell and White Pine Software, a desktop networking developer based in Nashua, N.H. White Pine plans to introduce, by late 1995 or early 1996, a commercial version of CU-SeeMe with data-compression improvements that enhance audio fidelity as well as the speed and quality of the video, even allowing transmission of color images. The enhanced CU-SeeMe will also help participants in videoconferences do collaborative work by featuring a so-called integrated whiteboard, a common workspace on which all users can write information with a special pen and pad for immediate viewing by everyone on the network. Other enhancements will include an alert box to announce incoming calls, improved security through password-limited access, and the ability to launch CU-SeeMe videoconferences from World Wide Web sites.

The Web feature is particularly intriguing to Dorsey, who thinks it will improve the ability of CU-SeeMe users to find each other on the Internet. He also would like to see users organize special-interest reflector sites, analogous to electronic mail newsgroups on the Internet, so CU-SeeMe can become a tool for more focused and productive conversations.

—MARK HODGES

Staying on the Road While Taking a Spin

First there were antilock brakes to prevent car wheels from slipping during braking. Then there were traction-control systems to prevent wheels from slipping during acceleration. Now there is a new antiskid technology that prevents a car from spinning sideways out of control in sharp or slippery turns.

Developed by engineers at the Robert Bosch Corp. and Mercedes Benz in Germany, the new stability-control technology features an onboard microprocessor that monitors a vehicle's intended speed and trajectory using input from sensors embedded in the car's engine, steering, antilock-braking, and traction-control systems. Taking input from the network of sensors, as well as a new spin sensor originally designed by the aerospace industry, the processor looks for any discrepancy between how a driver is attempting to turn the car and how the car is actually turning. If the processor finds even a slight difference, it automati-

cally takes corrective action—far faster and more effectively than the driver could respond—to prevent the vehicle from skidding out of control.

The heart of the new system is the spin sensor, first developed by GEC Avionics of Rochester, England, for use in precision-guided missiles. The sensor, which is placed at the center of the vehicle in an upright position to monitor the car's rotation about its vertical axis, consists of a small steel cylinder with eight piezoelectric transducers spaced equally around its rim.

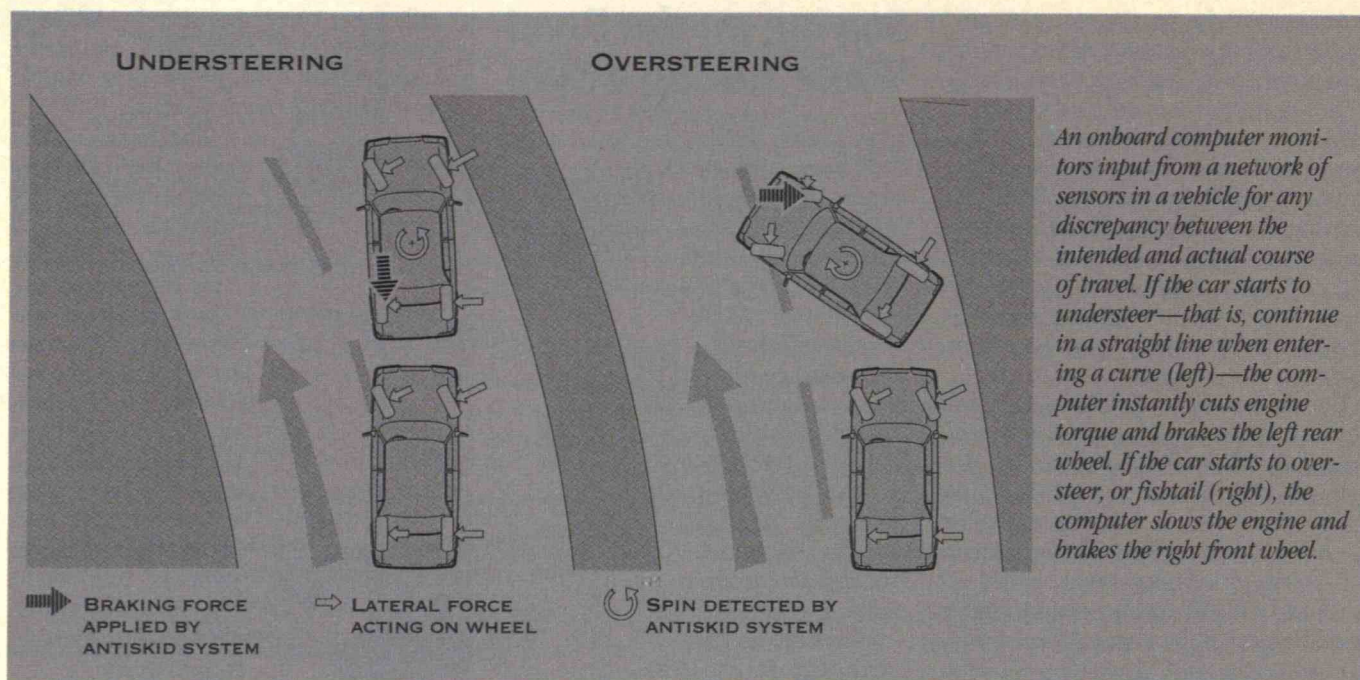
A piezoelectric transducer can operate in two modes: When it receives electrical signals, it transforms them into mechanical motion. Conversely, when mechanical pressures or vibrations are applied to a transducer, it converts them into electrical signals, such as when a phonograph needle produces signals in response to bumps in a record groove.

The microprocessor in the antiskid device sends timed electrical signals to the transducers in the steel cylinder, causing it to vibrate like a church bell. The vibration in turn creates a vaguely cross-shaped standing wave inside the tube. During the intervals



Equipped with a new antispin system originally designed for precision-guided missiles, the top car (in each of the three pairs of photos above) stays on course, while an unequipped but otherwise identical car traveling under the same conditions (at bottom in each pair) skids out of control.

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when the transducers are not receiving signals, they are sending signals back to the microprocessor in response to the pressure from the vibrating tube, in effect monitoring the position and shape of the wave.

When the car spins even slightly, the nodes of the standing wave shift around the cylinder wall in a direction opposite to the car's rotation. The transducers then relay the changes to the microprocessor, which calculates the velocity at which the car is turning. If the rotational velocity does not correspond to input from the car's other sensors regarding speed and turning angle, the microprocessor is programmed to send signals back through the sensor network to adjust engine torque and apply one or more brakes as needed.

Built for Speed

Because the system can typically respond within 40 milliseconds—some seven times faster than a human can react—engineers at Bosch and Mercedes Benz believe that the antiskidding technology could significantly reduce the fraction of all traffic deaths—currently 4 per-

cent—that results from single-car spinouts.

According to Anton van Zanten, leader of the Bosch research team, drivers tend to lose control of the car when its rotation about the vertical axis exceeds 10 degrees on dry surfaces or 4 degrees on packed snow. Given quickly changing road conditions, drivers cannot accurately gauge the vehicle's lateral stability. Moreover, when the car starts to slip, creating a condition known as "understeering," the driver is usually caught by surprise and often panics and suddenly "oversteers" the car.

The new system measures any tendency to both understeer (causing the car to continue in a straight line when entering a curve) or oversteer (causing the rear wheels to fishtail). If a car understeers and refuses to follow the curve, the stability-control system might correct the error by braking the inner rear wheel (inner with respect to the curve). The system may also reduce the vehicle's momentum by throttling back the engine or by engaging other brakes. Conversely, if the rear axle is close to spinning out, the system may act as a stabilizer by reducing engine speed and

applying the outer front wheel brake.

In early tests of the new system, Daimler Benz researchers asked 80 people to take "drives" in the company's driving simulator both in cars equipped with the antiskid system and in those without. While all the test drivers made it through a programmed icy patch without an accident in cars with electronic skid assistance, 78 percent of those in cars without the new system wound up in a simulated ditch.

The stability control system is being offered as a \$750 option on the Mercedes V8-engine-powered S-Class cars, which have standard antilock brakes and traction-control systems. In 1996, stability control becomes a \$2,400 option—\$1,650 of which covers the cost of the traction-control system—on six-cylinder S-Class cars.

Elsewhere, ITT Automotive of Auburn Hills, Mich., says it has developed a similar antiskid system for use in models from six car manufacturers and is adapting the technology for use in buses and large trucks. The company expects the system will begin to appear on vehicles worldwide by the end of the decade.—STEVEN ASHLEY

Fertilizing Scientist-Farmer Collaborations

In a range of low mountains in southeastern Mexico, a vigorous vine called velvetbean blankets the region's corn fields so thickly that sometimes only the corn's tassels protrude through the lush green carpet. But this vine is no Latin American version of kudzu—a gonzo weed that smothers everything in sight in the southern United States. Rather, velvetbean is a leguminous “green manure” crop that benefits the corn much as chemical fertilizers and pesticides would—if these farmers could afford them.

The flourishing velvetbean ground cover controls weeds by robbing them of sunlight while still allowing the taller corn to continue growing above. The vine's roots prevent soil erosion. And because velvetbean draws copious amounts of nitrogen from the air into its leaves, stems, and particularly its roots, it adds a natural fertilizer to the soil when the plant decomposes at the end of the growing season.

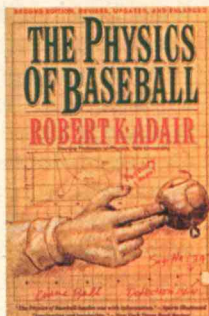
During the last century, velvetbean (plants in the genus *Mucuna*) was used to feed animals and fertilize fields in Asia, Africa, and the United States. In the early 1900s, operators of Central American banana plantations began to use the vine as a green manure. From there it spread to indigenous farmers in Guatemala and eventually to Catemaco, Mexico, where crops in the area's steep hills needed all the help they could get as corn yields fell because of depletion of nutrients in the soil and erosion.

By 1991, the use of velvetbean, which had spread to about 150 Catemaco farmers, came to the attention of the Sierra Santa Marta Project, a non-governmental organization supported by the National Autonomous University of Mexico, Carleton University in Canada, and CIMMYT, a Spanish acronym for the International Center for Corn and Wheat Improvement, based near Mex-

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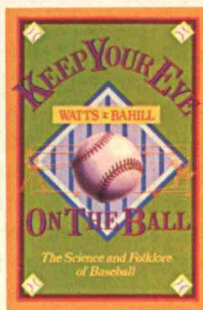
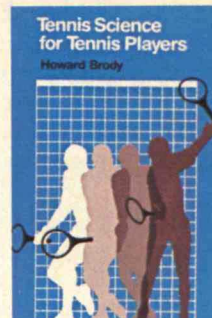
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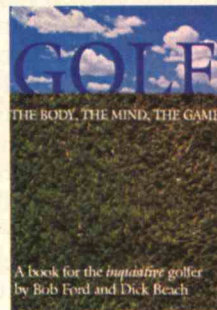
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ico City. The project sought to disseminate the news. Instead of hiring outsiders as agricultural extension agents, the project officials sought to take advantage of the local farmers who had brought velvetbean to the region in the first place. And while they supply their so-called "promoters" with videos and handouts in two native languages, Nahua and Popoluca, they rely mainly on farmer-to-farmer communication.

Doroteo Gonzalez, one of the 55 local farmers who doubles as a part-time promoter, says that besides velvetbean's effectiveness at controlling weeds and drawing "free" nitrogen from the air, the vine's ability to curb soil erosion has made believers of many of his peers. In fact, during the summer, when the corn grows under intense rains, CIMMYT scientists have measured 22 tons of soil washing off each acre not protected by velvetbean. By stabilizing the soil with its roots and protecting soil from rainfall with its leaves, velvetbean reduces erosion to about 2 tons, according to Daniel Buckles, an anthropologist formerly at CIMMYT and now with the Interna-

tional Development Research Center in Ottawa, Canada.

While reliable yield figures were not available in Catemaco, velvetbean has doubled or tripled corn yields in the winter crop in Honduras, from 900 pounds per acre to between 1,800 and 2,700 pounds. With advantages like these, velvetbean is catching on fast; around Catemaco, 3,500 farmers now use it, a 23-fold increase since 1991.

Learning from Locals

The story of velvetbean illustrates the success of a new form of cooperation between scientists and farmers. In Catemaco, farmers are not being treated as receptacles to be filled with ideas from scientists but as innovators—and as collaborators with each other. "Farmers need to be more self-reliant in getting and spreading information," says Buckles. The velvetbean project has thus encouraged farmers to teach each other what they know.

Likewise, says Buckles, "we as researchers can learn from what they are doing to solve problems." For example, farmers have used informal tests to resolve the key technical issue of when to plant the legume. If velvetbean is planted too soon, it deprives corn of sunlight; if planted too late, it will not grow enough

to produce significant amounts of nitrogen to fertilize the fields. Farmers in the Sierra Santa Marta have learned to plant velvetbean 30 to 50 days after they plant corn, so the vine will not smother the corn seedlings. Farmers have also identified six other useful legumes with potential as green manure crops.

The velvetbean project is taking place against a backdrop of growing interest in indigenous agricultural techniques, says D.

Michael Warren, professor of anthro-

pology at Iowa State University and director of its Center for Indigenous Knowledge for Agriculture and Rural Development. "We've been fighting for that for 20 years, trying to get development professionals to recognize that it's more cost-effective to work with and through existing systems."

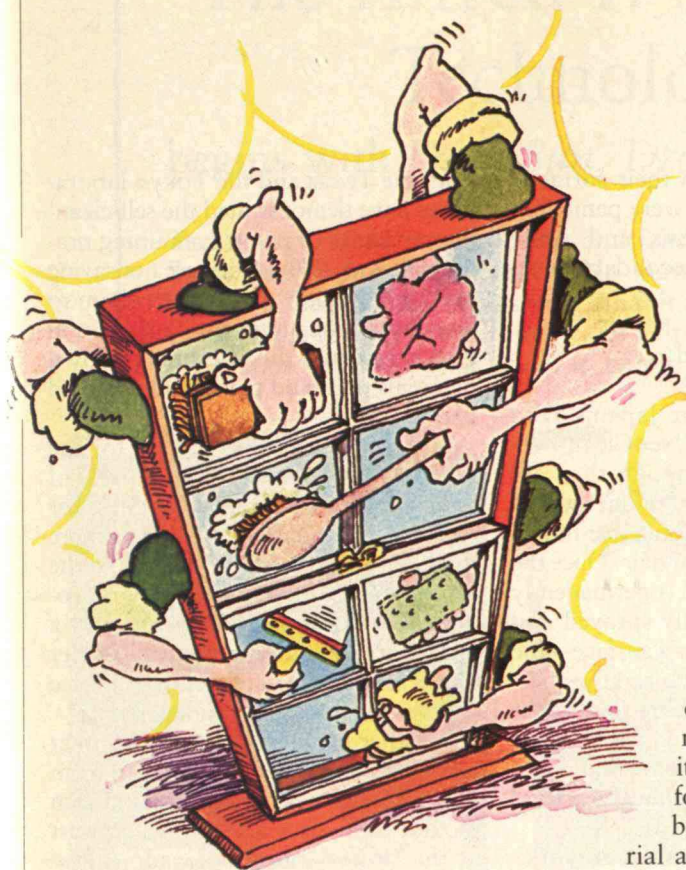
In a recent speech at a workshop on agriculture and natural resource management sponsored by the World Bank, Warren noted that the first step is to recognize that indigenous knowledge is worth investigating and recording. "Then you have to understand its strengths and weaknesses and how it complements or doesn't complement" other agricultural systems. Warren adds that this process is already under way in about 20 countries, including the United States, Mexico, Brazil, Nigeria, Kenya, and Indonesia, where groups collaborating with his center in Ames, Iowa, are recording local agricultural knowledge.

These groups have discovered unschooled farmers who have invented low-tech irrigation systems, improved every major crop through cross breeding, and found thousands of uses for native products. One of the most promising of these products is a natural pesticide derived from the neem tree, a native of Africa and Asia that Indian villagers have long used to control mosquitoes, grain pests, moths, and other insects. Researchers at the U.S. Department of Agriculture in Beltsville, Md., have found that extracts of neem seed deter feeding and disrupt mating in at least 135 species of insects, including cockroaches, Mediterranean fruit flies, gypsy moths, and locusts. Unlike many synthetic pesticides, which are neurotoxins, neem does not seem to affect mammals. A neem extract has since been developed by the Scotts Co. for controlling insects on ornamental plants and lawns.

Buckles says that recognizing the value of indigenous knowledge serves farmers and scientists alike. "We see that farmers come up with ideas that are worthy of attention," and they see that "we can do research that interests them."—DAVID TENENBAUM

Mexican farmer Doroteo Gonzalez, shaded by a velvetbean vine, promotes planting the so-called "green manure" in cornfields to fertilize the soil, control weeds, and curb erosion.





A Self-Cleaning World

For those who detest cleaning chores, imagine materials that clean themselves. Scientists in the United States and Japan have recently reported progress in harnessing the powerful catalytic properties of titanium dioxide for use in tile, glass, paint, paper, and cloth products that can keep themselves looking sparkling clean. The first item to reach the market, a self-cleaning wall and counter tile, can not only kill bacteria but also eliminate odors and staining associated with smoke from cooking oils and cigarettes.

The key to the self-cleansing world of the future is the interaction between titanium dioxide and ultraviolet rays from the sun or fluorescent lights. The special properties of titanium dioxide—a substance used to make paint and toothpaste white—were first discovered by Tokyo University chemist Akira Fujishima and his associates in 1969. Their research showed that when exposed to solar energy, titanium dioxide has the ability to break down water into hydrogen and oxygen.

After a quarter-century of observation, scientists now understand that the reaction occurs as titanium dioxide absorbs energy from the UV band of sunlight and reacts with water vapor in the air to produce oxygen molecules. These molecules are energetic enough to break down organic matter into carbon dioxide, and trace elements.

"When light shines on the white paint pigment, titanium dioxide, it produces an active form of oxygen that can burn combustible material at room temperature,"

says David Ollis, a professor of chemical engineering at North Carolina State University. "It is a fire without a flame."

Originally, scientists assumed that the first application of titanium dioxide's ability to tap the energy in sunlight would occur in electrochemical solar cells that extract hydrogen from water. Indeed, the first of these cells was built at AT&T's Bell Laboratories in 1977. But, despite improvements in the technique over the years, the devices have not been efficient enough to compete with conventional fuels.

In the wake of titanium dioxide's failure as a miracle fuel source, scientists have turned their attention to using the compound as a cleaning agent. They have discovered that titanium-dioxide-coated materials can easily remove thin deposits such as bacteria and fingerprints, though they are unable to break down thick splotches of organic materials—such as blood stains—because light and oxygen in the air cannot reach the surface where the reaction occurs.

Fujishima says that when titanium-dioxide tiles were used in the operating rooms and bathrooms of Ako Central Hospital in Ako, Japan, they killed 99.9

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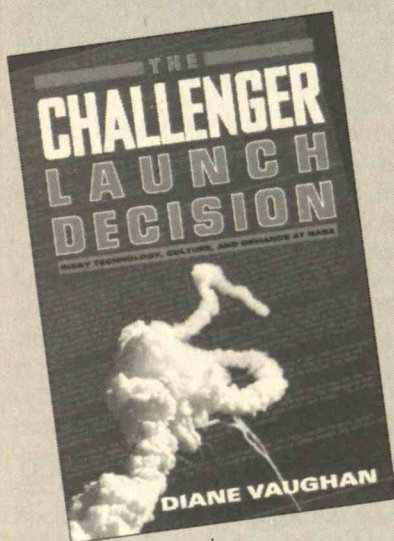
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percent of bacteria on their surfaces. Included among them were penicillin-resistant staphylococcus and other germs that can cause secondary infections among patients.

A Versatile Compound

The tiles—marketed by Japan's Toto Corp. under the name NeoClean—remain effective even though they are coated with a layer of titanium dioxide only one micron thick, about one-fiftieth the diameter of a human hair. Once the fine layer of compound is permanently affixed—it is commonly sprayed and then baked onto the tile's surface—the company says it is resistant to the abrasion of ordinary scrubbing that might be needed for thicker stains. Moreover, because titanium dioxide acts only as a catalyst for the photochemical reaction, it theoretically never gets used up.

How fast does the process work? While cleaning time varies with the thickness of the deposit, Adam Heller, a professor of chemistry at the University of Texas at Austin, says his experiments show that titanium-dioxide-treated glass removed fingerprints in about two hours. This glass, versions of which both Heller and Fujishima have developed, could be made reactive on both sides, making it ideal for everything from skyscraper windows to car-window glass.

The Japanese have tested other titanium-dioxide-treated materials as well. Kazuhito Hashimoto, a chemist at Tokyo University, applied the compound to a porcelain urinal. After a month, the treated urinal looked sparkling clean while an untreated unit was blotched and yellowed. Elsewhere, researchers are experimenting to see if the tiles can keep themselves clean on the walls of heavily polluted car and truck tunnels. And a Japanese paper company is developing windows and partitions for Japanese houses while a camping-equipment manufacturer is experimenting with self-cleaning tent fabric.

But the pièce de résistance of self-cleaning will likely be wash-itself paint.

Both the Texas and the Tokyo laboratories have demonstrated the self-cleaning capacities of paints containing titanium dioxide. While they are not saying exactly how they did it, both claim to have overcome an intrinsic problem in which titanium dioxide breaks down materials that bind pigments in colored paints.

Still, several hurdles remain for the self-cleaning products, not the least of which is their high cost. The tiles, for example, sell for about 30 percent more than existing products. And while the Japanese claim their technology will produce a stay-clean paint that costs only a little more than its competitors, Heller thinks his product may cost two or three times as much as conventional paints.

Another problem may be consumer fears of toxic byproducts that can form as intermediaries during the titanium dioxide catalysis. Carl Koval, a chemist at the University of Colorado, questions whether intermediaries such as benzenes and phenols, also produced by burning carbon fuels, might turn titanium dioxide into "the asbestos of the future."

But advocates argue that the concentration of contaminants produced on the surfaces of titanium-dioxide-treated materials would be tiny. "The maximum amount of benzene emissions from a 10-foot-square area would be approximately 1/10,000th of that from a fire in your home fireplace," says Heller. "It would be less than one-millionth of the intake you would be exposed to if you were driving behind a diesel truck."

Nonetheless, Heller would like titanium dioxide's self-cleaning products to be certified by health and safety monitors. "If you want to sell tiles that are supposed to clean microorganisms," he says, "then you want that claim to have FDA blessing."

While large-scale application of the technology is probably some years in the future, scientists believe the torch for developing it has definitely been passed. "Now," says Ollis, "the more imaginative work will occur in industry rather than academia."—STEPHEN STRAUSS

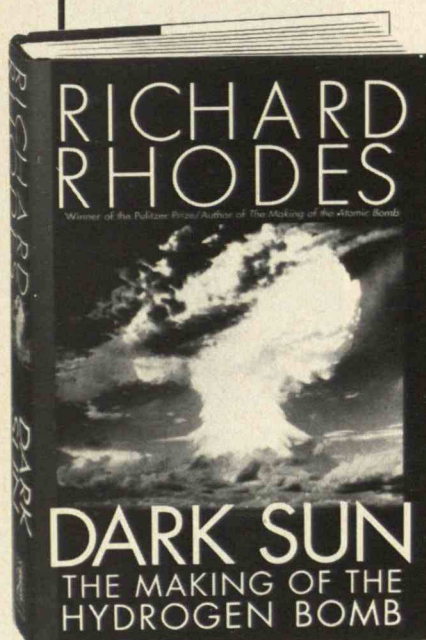
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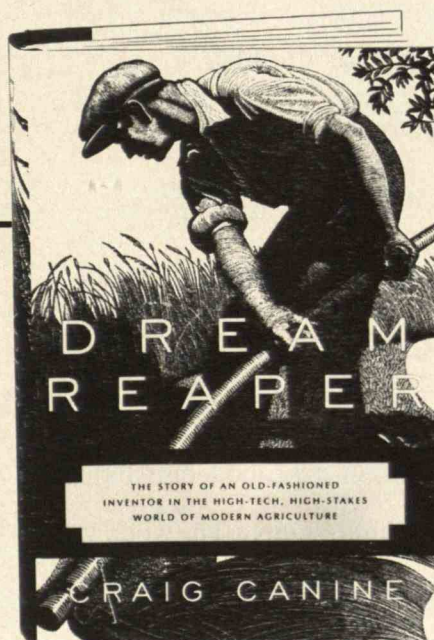


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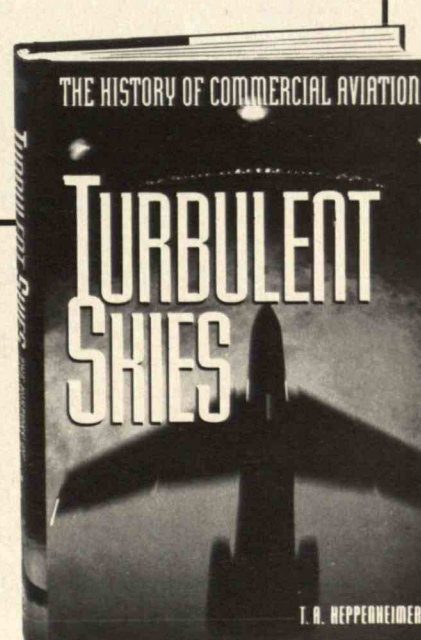


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TECHNOLOGY

Amish Style

*When it comes to technology,
the Amish aren't really close-minded, just choosy.*

*And given the success of their way of life,
we might want to take some lessons from them.*

BY ERIC BRENDE

We were busily working, the Amish crew and I, dismantling an old house to gather a cheap lumber supply. The wood would be used for a new dwelling now partially completed on the southeast slope of my recently purchased property. After a year and a half living amongst the Amish, my wife Mary and I have decided to stay, and although we have declined to join the Amish church, our “advisory board”—a plain-dressed widower and his four grown children—has exceeded what we thought possible in their friendliness and eagerness to assist. “Eric...!” someone was calling to me. “Maybe you could come over here and do this for us.” What special task have they singled out for me? I wondered. I tiptoed across the exposed floor joists and looked. On the floor below, one of my new Amish friends gazed up plaintively and pointed to an overhead light fixture near my feet. “Could you please take those lights down?” he asked. I suppressed a giggle. I no more knew how to take apart an electric light than how to tie a double half-hitch. Did he actually sup-





PHOTO: JIM STEINBERG/PHOTO RESEARCHERS INC.

pose that because I had grown up in an electrified environment I knew how electric lights were put together?

In fact, he might well have made such an assumption. In many or most Amish settlements, everyone *does* know how to do everything. Many women know carpentry, including the daughter in the family that was helping me tear down the old house and build the new one. The other day I happened upon an Amish wife sawing boards for a piece of furniture she was building. Cabinetry is her hobby. Simply speaking, most work demands that have been broken down into innumerable fields of specialization in modern technological culture have remained whole among the Amish. Families will fail to make ends meet unless all household members know how to do sundry interconnected tasks—among them growing, preserving, and preparing for the table most of their food; constructing and maintaining homes; making clothes; and often even medicating themselves.

Underlying the reluctance to specialize is an awareness of how well shared know-how helps keep Amish society stable. Without it, how could Amish neighbors so readily join together in undertakings such as tearing down or building a house? Or threshing wheat? This is not to say the Amish are necessarily experts in each of the tasks to which they aspire. "I don't do anything long enough to get good at it," an Amish fellow once told me with a self-effacing chuckle. Still, the extent of their mastery is considerable. A glance at their efforts reveals beautiful, well-maintained farms thriving in an age when many others cannot even survive. Inhabitants of what seems to be a provincial backwater, the Amish turn out to be surprisingly enlightened, at least with regard to the material conditions of their life. Next to them I feel sheltered from the world around me.

I feel oddly ungrounded as well. Life in a fast-paced society is next to impossible without narrowing one's focus—few of us have the time to learn the inner workings of such conveniences-cum-necessities as cars and computers—and it is axiomatic that in narrowing one's focus one can lose sight of the larger picture. But that's not the only problem. New developments continually evolve in the myriad areas that this narrowed focus excludes. The result is that people are often plagued by what seems like uncontrollable change.

The Amish, by contrast, consciously steer their cultural course in the sea of alternatives opened by technological advance, accepting only those

that enhance their way of life. If the Amish plead ignorant on the subject of electrical wiring, for instance, it is because they have made an active decision not to avail themselves of the technology. Installing electricity would only permit them to plug in clever contraptions that could, at the push of a button, shift much skilled work away from them, reducing the need for shared know-how and the opportunities for community building.

Word of how successful the Amish way of life can be is spreading, and for not a few, curiosity has enkindled conversion. In the community near us, I can think of at least 10 separate parties, either individuals or families, who have initiated the process of baptism into the Amish Church. But I doubt that it is necessary to embrace the Amish religion to attain their community cohesion or their sense of connection to the material world.

A Tradition of Innovating

The full extent of the differences between Amish society and mainstream America becomes clear every time the Amish council near us meets. Members present are allowed to speak their minds on any matter before the community: since everyone has intimate knowledge of how the whole of Amish life works, everyone is considered competent to volunteer insights and ideas as well as assist in decisions. If anyone has clout, it's principally because of experience—first speaking rights go to older members. The practice of drawing lots for central Amish leadership positions underscores people's confidence in their mutual abilities.

Interestingly, one of the recurring items on the agenda is technology. Unlike mainstream technologists, who never test the social impact of their products but unscientifically presume a beneficial effect, the Amish often adopt new technologies only after a trial period in which they assess the effects. For example, when members of the local community began using a nearby pay phone to facilitate sales of produce to regional grocery-store chains, a council was called to discuss the possible ramifications. Participants pointed out that lightning-fast communication across the miles was undermining the face-to-face intimacy so important to their community. But they also observed that without the phone they would be at a competitive disadvantage among suppliers to grocery stores, which prefer up-to-the-minute information on shipments. Out of this dilemma came the decision to urge only sparing use of the phone.

At times the Amish actually promote technological development. After all, some technologies help perpetrate a tight-knit community. The Pioneer Maid wood cookstove is a case in point: con-

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ceived by two Amish brothers, Elmo and Mark Stoll of Aylmer, Ontario, and now produced by an Amish factory, it was the first wood cookstove in North America to employ an airtight combustion compartment. The only significant advance in household wood-fired stoves in 300 years, it efficiently cooks food, heats a water supply, raises bread dough, dries vegetables, and warms 2,000 square feet of living space all at the same time. The stove does require a sizable repertoire of domestic skills and knowledge to operate, but because everyone needs to operate it, vital resources and activities remain in the purview of the community and help hold it together.

Similarly, an Amish blacksmith in Indiana has refitted the motor-driven John Deere 24-T hay baler with a slick assemblage of gears, drive-chains, and a steel wheel from the 1940-vintage W-30 International Tractor. Unlike the balers used by the Amish everywhere else, which are drawn along by horses but use fuel-powered engines for the actual task of baling, this one is powered entirely by horses. And in the community next to us, Amish farmers have resurrected an old stationary threshing machine. They salvaged the transmission of a junked cement truck and fitted it with wooden shafts that fanned out from the hub. Five teams of two horses each are hitched to the shafts, and when they move forward, horsepower is redirected along a rubber belt that connects the transmission with the threshing machine. Having threshed with the innovative Amish crew two summers in a row, I can avow that the contraption leaves ample work to bond together a gang of laborers.

Indeed, the Amish were, from their beginnings in seventeenth-century Europe, leaders and innovators in agricultural techniques. While most Alsatian peasants were still using the sickle, the Amish had moved to the more efficient scythe, which allowed a greater range of motion and required less stooping. They were also forerunners in practices like rotating crops, irrigating meadows, and using clover and alfalfa to build up the soil. Hoping to improve the productivity of the land in their jurisdictions, progressive eighteenth-century noblemen enticed the Amish to settle in Poland and Russia, while more recently Mexico, Belize, and Paraguay have welcomed Amish immigrants with open arms.

Even though traditionalism may prevail among the Amish, often the tradition itself is one of tinkering, adaptation, and innovation. Ivan Glick, a farmer and writer especially interested in agricultural history, points to the large number of surprisingly competent self-taught engineers in the Amish settlement of Lancaster County, Pa. And





From their beginnings in seventeenth-century Europe, the Amish were innovators in agricultural techniques.



in some cases where the Amish have resisted technology, history has vindicated them. For instance, they have been the living cornerstone for a nationwide return to horse farming, which they have proven is "much more profitable than tractor farming if done correctly," according to agricultural industry observer Baron Taylor of Lancaster County. Though feasible only if the scale is not too large, the practice keeps capital costs low and promotes sustainable soil management, enhancing land value and use. The number of non-Amish horse farmers has tripled over the last 20 years and now exceeds that of the Amish.

More striking than Amish technical command, however, is Amish emotional health. According to a study by psychiatrist Janice Egeland, Amish people suffer non-organically based depression at a small fraction of the national rate. And then there's the strong Amish family. The Amish divorce rate is next to nil, and only about one in four Amish offspring leaves the community.

While there are doubtless a variety of reasons for such impressive statistics, my firsthand acquaintance with the Amish leads me to believe that copossession of vital know-how is certainly one of them. It helps unite spouses by giving women a fuller sense of partnership in the overall household enterprise and a more visible, respected place in the community. I suspect that it also puts parents in an excellent position to *be* parents—to instill emotional stability and adult responsibility in their progeny. Amish parents are their children's primary educators, employers, and financiers—a position that would hardly be possible if they had not acquired the lion's share of the society's knowledge.

The work of child psychologist Urie Bronfenbrenner reinforces this notion. In his book *Two Worlds of Childhood* comparing child-rearing practices in the United States and the Soviet Union, Bronfenbrenner asserts that children who can meaningfully participate in the world of adult work enjoy far greater psychological well-being than children deprived of such participation—and so do the adults those children become.

Brave New Boundaries

Unusual as the Amish may seem, their roots are not very much different from those of mainstream society, which may help explain why some conversions to their way of life succeed. Sociologist Max Weber employed the term Protestant ethic to account for the meticulous industry widely in evidence among Calvinists and their cultural descendants, including white Anglo-Saxon Protestants. It could be argued that this industry has been dupli-





cated by the Amish in agriculture. Historically, both Calvinism and the Amish church have sparked behavior that suggests a close psychological tie between earthly works and personal salvation. Perhaps the key difference between the two religions is the greater Amish emphasis on membership in Christian community, which they see as a prerequisite for redemption. Amish theology, far more than Calvinist, provides religious incentives for channeling industry into social solidarity.

Conversion is an uphill battle, however. One youth I know who was about 22 when he entered the local Amish church became dismayed at the amount of catching up he had to do, and not just in the area of know-how and skill. His Amish friends received help and money from their parents, enabling them to buy buggies and save up for marriage and a farm. Without similar support from his own parents, who lived several hundred miles away and had none of the same resources, he languished. He finally left—but not without heartache, for he had grown attached to the community and its ideals.

The Amish stress on religious dogma is another reason why converts may leave. The list of possible complaints, to be sure, can be daunting: that Amish religious indoctrination of the young generally leaves little room for

critical or creative thought; that the traditionalism informing every sphere of Amish activity can inhibit even common sense; that the practice of shunning adult backsliders is unduly harsh; that baptism into the Amish faith, while ostensibly voluntary, is expected by parents when a child comes of age and virtually foreordained; and that, in short, the survival of Amish culture can be attributed less to anything positive than to inertia and the fear of change and reprisal. Amish expert John Hostetler, quoting a formerly Amish woman, notes that “in Amish society one is always conscious of keeping as many rules as one can, and each person tends to feel an obligation to see that other members of the family also keep these rules.”

On the other hand, it is worth remembering that it was the Amish themselves who set up the rules, and that their efforts have borne fruit in a flourishing handicraft civilization and an oasis of religious sentiment. As Hostetler himself remarks, “conformity implies that persons are committed to the goals and means of their culture, voluntarily accept them, and live in a state of commitment to the appropriate rewards.”

Yet while religion is inextricably interwoven with Amish practice for the Amish themselves, for the rest of us such issues can be kept more distinct. My wife and I are in the midst of an



attempt to initiate an alternative to Amish community that is less enmeshed with dogma. Chary of religious codes of technological enforcement, we nonetheless appreciate the need such measures address: that of conscious boundary setting, backed by some kind of clout. Without some such boundaries, seekers of alternative lifestyles could easily drift and remerge with the practices they have set out to avoid. Several other communities already in existence in this country employ one or another method of common discipline: land trust or coop or commune. For our part, we are trying to translate the Amish religious codes into deed restrictions, aiming for a kind of low-technology zoning. By legally limiting electric and telephone lines, as well as motorized farming and wood-cutting devices, we aim to help establish on a circumscribed space nonsectarian guideposts for the kind of social stability the Amish enjoy.

In other words, we hope for the best of both worlds: a reliable structure for neighborly solidarity without the pincers of theological sanction. This is not to say that we have disallowed religion. In fact, we are practicing Catholics ourselves. But we do not wish to make religious belief the basis of technological norms. We welcome anyone who shares a desire for technological simplicity.

Other ways to further the same ends might include a summer internship program in homesteading for college students, or a school for homesteading apprentices that would complement the conventional liberal arts curriculum. Plunging into the nitty-gritty versatility our ancestors once shared, students would pick up new skills, enhancing, shall we say, their career options. The Cabin Fever University at Celo, N.C., the Shelter Institute of Bath, Maine, and the Christian Homesteading Movement of Oxford, N.Y., are already pursuing this idea. I hope one day to inaugurate something similar here on our own homestead—if I ever know enough to do it.

But even in the absence of such opportunities, the mere example of Amish settlements is instructive. In a world whose rapid changes give credence to the notion of unstoppable "progress," the Amish remind us of what may have helped to propel much of that progress: Francis Bacon's dictum that knowledge is power. Amish successes are an index of what we can achieve by attempting to integrate practical knowledge and social intimacy. They teach us not that the modern world can or should somehow be ignored, but that within it—even as part of its own program—something vital from the past may persist. And perhaps even nose ahead of the present. ■

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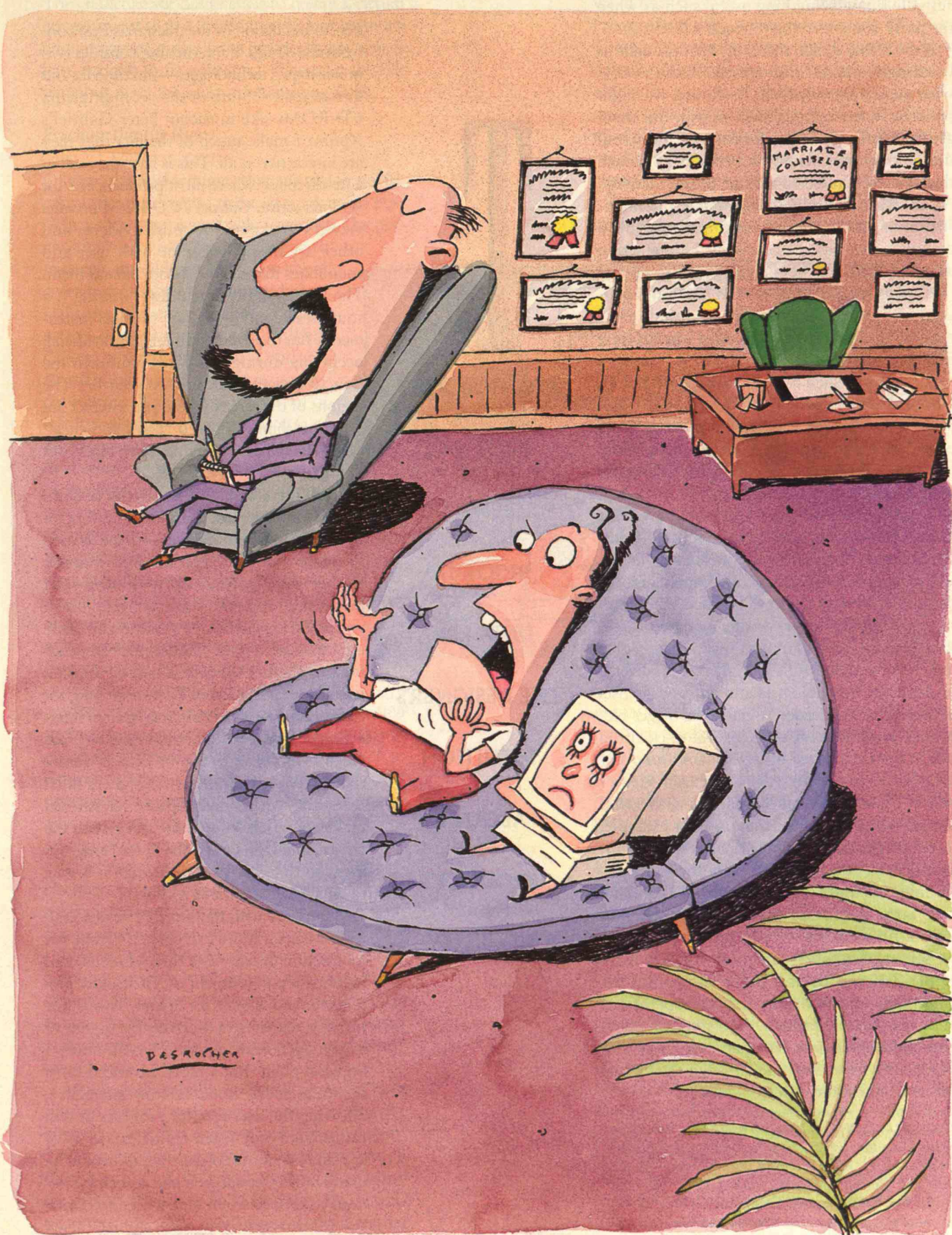
Interactivity with a Human Face

BY HUGH ALDERSEY-WILLIAMS

“**V**oice-mail jail,” they call it. You telephone someone at work, using their newly provided direct-dial number. Progress, right? If they are not there, you “press 1” to leave them a message, “press 2” to leave a message for someone else, or whatever. More progress. In practice, however, you are steered through an impersonal maze of unwanted choices among undesirable options. There is no indication as you begin your call of how long you will be tangled up in this mess, and nothing to confirm that your message really has been recorded or whether it will get to its party and if so when, and whether it will be listened to and acted upon. Worse, there is often no way to back out to speak

A CONVERGENCE OF PEOPLE-ORIENTED PROFESSIONALS SUCH AS PSYCHOLOGISTS, ANTHROPOLOGISTS, ANIMATORS, AND DRAMATISTS COULD HELP ENGINEERS AND DESIGNERS MAKE TOMORROW'S INTERACTIVE PRODUCTS CONSIDERABLY EASIER TO USE THAN TODAY'S.

ILLUSTRATIONS BY JACK DESROCHER



DASHOCHEN

to a real person—*any* real person—who might actually know something useful such as when the party you are trying to reach will return.

If the techie design mentality that brought us voice-mail mazes and unfathomable VCRs were merely extended into the future, we might be in for a frustrating time indeed. But there are hopeful signs that traditional industrial design may give way to a broader approach that is better suited to the age of interactivity. An infusion of skills from outside the mainstream of product design is gradually forging a discipline that has been christened “interaction design.” The new field’s mission is to ensure that complex encounters with machines proceed smoothly and naturally, and that information is exchanged in the most appropriate manner and form.

A few firms such as Palo Alto-based IDEO, whose clients include the likes of AT&T and Sony, have already established themselves as providers of interaction design expertise, and a handful of leading electronics companies, such as Philips in the Netherlands and Xerox Corp. and Apple Computer in California, have built interaction design teams. Although the traditional design disciplines have their role—industrial designers for the boxes and panels, graphic designers for data display, architects and interior designers for representing complex three-dimensional screen environments—the teams tend to be peopled with specialists from diverse professions. Psychologists and anthropologists in particular are needed to paint the bigger picture of products that are used not in isolation but in the context of other devices and other people. Xerox Palo Alto Research Center (PARC) has teamed psychologists with social scientists and computer scientists, for example, to create products such as the database manager Visual Recall, which uses three-dimensional grids and treelike hierarchies to make very large databases easier to organize and search. Animators have informed the design of on-screen “agents”—cartoon figures from Apple, Microsoft, and other companies for guiding people through computer operations in a user-friendly fashion. And stage directors and choreographers will pace the drama of interaction over time and through the virtual spaces of our future electronic tools.

HUGH ALDERSEY-WILLIAMS, a freelance journalist who lives in London, writes about technology, design, and architecture. He is the author of World Design: Nationalism and Globalism in Design (Rizzoli, 1992). His latest book, The Most Beautiful Molecule (Wiley, 1995), describes the discovery of buckminsterfullerene.

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New Media, New Pitfalls

For an indication of the dilemmas that confront the design of interaction, consider two much-hyped technologies—multimedia and virtual reality. State-of-the-art multimedia CD-ROMs like musician Peter Gabriel's *Xplora 1* make much of the fact that they are interactive at all. This is how they sell in a marketplace where most products are not yet interactive. Gabriel's CD-ROM permits viewers to experience music, videos, and other art forms, together with text and soundbites that tell the stories behind them. The interactivity includes “mixing” a soundtrack and “playing” musical instruments. But the interaction is highly artificial, occurring during awkward pauses in the flow of images while you do your bit. The regions of the screen where you interact are often just thinly disguised “point-and-click” boxes. It's all a bit too much like filling out a form.

Some predict that as the novelty of combining music, video, graphics, and text on CD fades, more natural ways will be devised to guide users through the information. Rather than putting up with stop-start progress as you take your turn to interact, you might experience the sensation of “driving” through a data “landscape.” Depending on whether the aim is quickly finding business information or lazily searching for entertainment, says Philip Joe, head of interaction design at IDEO, “there may be times when I will prefer to ‘fly’ or ‘bicycle’ rather than ‘drive.’” Interaction designers must recognize where this choice is desirable, make sure users know how to exercise the choice, and then design the virtual environment so that navigation through it is true to whichever metaphor is chosen.

Compared with multimedia, virtual reality presents a more extreme challenge for interaction design. The three-dimensional immersive environment of VR usually presents limited choices for action. This is fine for, say, teaching taxi drivers the layout of a city: each road junction would mark a decision point. But a more advanced form of virtual reality would be truly interactive, allowing the user to alter progress at will rather than only when invited to do so. A system to train surgeons, after all, would be useful only if the surgeon had complete freedom to decide when and where to cut or suture. Unfortunately, such environments

require immense amounts of computer memory. The challenge for designers is to create a virtual environment that is sparing enough of memory and processing power to be practical and yet realistic enough to be absorbing. This sort of task demands more than just programming skills.

Psyching Out the User

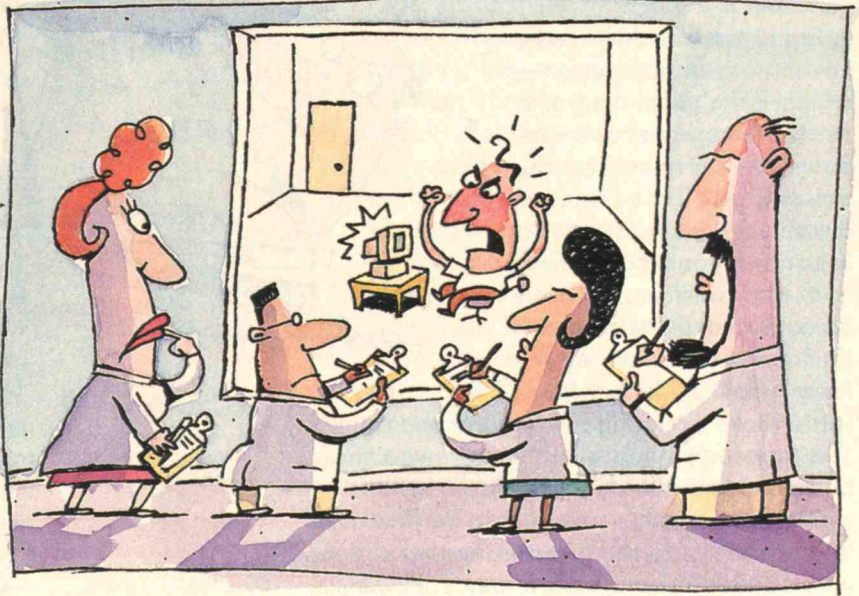
Of the various disciplines that are merging with conventional design to make such advances possible, psychology is probably foremost. The psychologist provides scientific rigor to underpin the designer's intuition about a product's usability. Three psychological specialties can contribute to interaction design, according to William Gaver, a psychologist at London's Royal College of Art. One is psychophysics. The logical extension of traditional ergonomics into the area of human visual and aural response, this field concerns itself with such matters as the legibility of typographic fonts on computer screens and ideal levels of brightness, contrast, and colors. Another specialty is cognitive psychology, which covers how we think, remember, and come to know things, and can reveal how best to present information and how much of it people can absorb. A computerized library catalog, for example, contains a vast amount of data. Screen choices must be presented so that the user finds the desired data as quickly as possible. Cognitive psychologists have the skills to determine whether this goal is best reached by presenting the user with many screens of gradually increasing specificity or with few screens containing larger amounts of data.

The third specialty, known as ecological psychology, examines how human perception and action are affected by the wider user environment. For example, Gaver, himself an ecological psychologist, is interested in how we identify events going on around us when we have only limited sensory data. One of his aims is to ensure that icons—visual symbols or sounds used to signal and identify particular functions—are readily interpreted.

Although the trend in computer icons has been toward greater realism—as in the perspective view of a wooden desktop seen on one recent “personal digital assistant”—experts are in disagreement as to whether these icons and metaphors should be lifelike or abstract, serious or humorous. “We are always communicating

with metaphors. The question is, which ones are we going to use?” says Aaron Marcus, an Emeryville, Calif., screen information designer. There may soon be room for all tastes, he predicts, as electronic equipment becomes available with a range of preferences built in. You might choose a desktop as the dominant metaphor if you are at work, but a shopping mall for browsing through data in a more leisurely manner at home.

Interaction with machines will grow more natural as psychologists explore the potential of



nonvisual signals, particularly sounds. Roy Patterson at the British Medical Research Council's Applied Psychology Unit is looking at ways to make alarm sounds in hospitals and transport more effective and less panic-inducing. Some aircraft have as many as 15 warning sounds, most of which come on suddenly and at full volume. Using a computer, Patterson can “sculpt” a graphical representation of a sound so that the alarm will come on gradually.

At Rank Xerox EuroPARC in Cambridge, England, the emphasis is on creating auditory icons, or “earcons.” The sound of approaching footsteps, for example, indicates that someone is about to open a dialogue with you on a computer network. The sound of “letters landing on the mat” advertises incoming electronic mail. “People talk about hearing in terms of things like loudness and timbre,” says Gaver at the Royal College of Art. “But what we hear are events—I hear ‘somebody walk by,’ I hear ‘cars.’” Psychologists can judge whether artificial versions of these sounds will be correctly interpreted—and tolerated—by equipment users.

Mastering Time

Perhaps the most significant new dimension that interactive products add to the design task is the need to structure the experience of the product over time. Yet the time dimension is unfamiliar territory to most designers. "Graphic designers have trouble with animation," says Joy Mountford, formerly manager of the human interface group at Apple Computer and now at Interval Research in Palo Alto. "But animators see things differently. They think of sound, plot, entertainment, narrative."

Animators can help make any movement on a screen—whether the gamboling of a deer or the opening of a window—seem "right" to the viewer or user. The influence of the animator is already seen on Macintosh equipment whenever the wastebasket icon becomes bloated with trash. Cartoon agents, such as the furry animal guides in Microsoft's "Bob" operating environment and Apple's 1987 prototype bow-tied "Phil," owe a more obvious debt to the animator's art.

Dramatists can also contribute to the flow of an interactive experience by ensuring that actions unfold in a logical and intuitive way. For example, Brenda Laurel of Interval Research has used theatrical improvisation to consider the question of whether a menagerie of on-screen agents or a single omniscient agent would be more effective in helping people use their computers. By having actors play the prompting role of the agents, she has found—surprisingly, perhaps—that many agents addressing you in parallel allow you to assimilate information more readily than one source. In other words, a cocktail-party atmosphere can be more enlightening for interaction than a lecture. This discovery would be hard to arrive at based on pure cognitive theory, says Laurel.

Fine-Tuning the TV Set

As yet, one is unlikely to find the full power of all these skills brought to bear on a single design task. The closest example so far may have been IDEO's design of a new television set for the European market from the Finnish manufacturer Nokia Consumer Electronics. The set, introduced in the fall of 1994, incorporates a graphical user interface that appears on the screen both for initial setup when assigning buttons on the remote control to

particular channels and for routine adjustment of sound and picture. The viewer has little need of an instruction manual even when performing sophisticated functions such as showing a picture from one channel within a picture from another channel.

The first stage of product development was to examine how people use their televisions in their own homes. This process was less rigorous than a full-blown anthropological study, but because it entailed actual observation it was more sophisticated than conventional consumer research, which tends to rely instead on surveys and impressions.

IDEO found that most people use only a few of the functions offered by state-of-the-art televisions, and that they tend not to readjust the controls once they have set them. Watching people watching television allowed the designers to group the major functions and adjustments in the

most useful way. It emerged that adjustments traditionally thought of as separate, such as volume and contrast, could usefully be grouped together on the display—say, for late-evening viewing, when one might wish to reduce both.

On the basis of their observations, the designers then engaged in role playing, modeling the conflicts that can occur within a television-viewing family. One new feature that emerged directly from this psychodrama aims to prevent one person from hogging all the convenient low-number buttons for programming his or her favorite channels: IDEO designed a remote that gives each person a color-coded button, enabling all family members to identify themselves and then program their preferred stations starting from 1. "The interaction designer's job is to make it easy for a family to resolve those conflicts; otherwise the most technically minded person dominates," says John Stoddard, IDEO's head of design.

After testing a few alternative designs on users, the team assembled a concept that drew together the most successful features of each prototype. In the final scheme, little control panels appear on the TV screen in as friendly and unobtrusive a manner as possible. Rather than popping out of nowhere, the panels slide up from the bottom of the screen (where controls are usually located) at a pace animated to resemble that of a CD drawer or video eject—



slow enough to look deliberate but fast enough not to keep you waiting. A succession of panels offers increasingly sophisticated control options, including a special contrast setting for black-and-white films and sound settings for different styles of music.

The final interface design required the collaboration of software engineers and product designers at Nokia together with designers, a cognitive psychologist, and Oliver Bayley, a "digital model maker," at IDEO. Bayley is skilled at programming, animation, and graphic design as well as the building of conventional physical models of products. It was his combination of aptitudes that led not only to this friendly animation, but to a number of visual improvements to the interface—for example, instructions appear on a solid background and hence are more legible than if they were superimposed on the moving screen image, and the buttons on the control panels resemble those on the remote control, making it easier for users to orient themselves.

Even the ethnographic angle was covered. As the designers polished the final concept, users in a variety of European countries tested the quality of interaction of the proposed remote control (simulated by a touch-sensitive computer screen) and the associated television graphics to ensure that they worked across cultures. The resulting product has won several design awards, and rival manufacturers have since adopted the same chip and similar screen graphics.

Just Like in the Movies

As collaborations like the one that produced the Nokia TV set become more common, so, undoubtedly, will frictions and tensions among the participating disciplines. Jargon is one obstacle. Designers often regard the technicalese of human-factors experts, anthropologists, and psychologists as anathema. For their part, these professionals are sometimes unwilling to adapt their modes of study to the demands of the commercial world. As Lucy Suchman, anthropologist at Xerox PARC, points out: "One would typically spend several years studying a society. This is in conflict with the short time frames for product development."

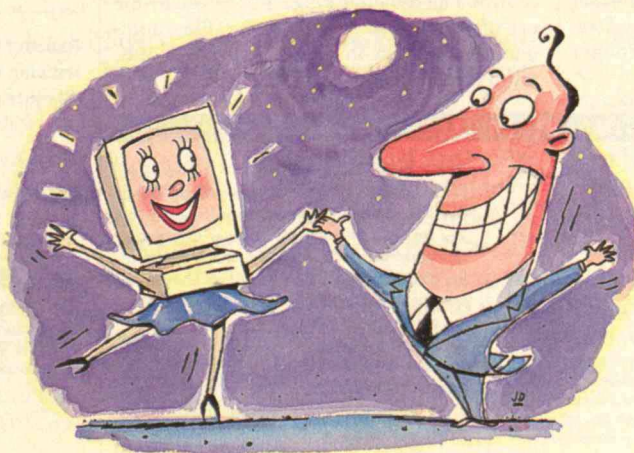
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FUTURE
IMPORTANCE.**

Many such tensions were long ago worked out in the world of filmmaking, which may therefore become the new paradigm for developing interactive products. Most films are made by short-lived companies that act as a temporary umbrella administration for numerous individuals whose talents are suited to the project at hand but who may not be regular collaborators. As in interaction design, the range of expertise encompasses both creative and technical skills. It was just such a team—an assemblage of film, video, and computer people—that created QuickTime, a widely used software package that enables Macintosh computers to compress and store video, animation, and music data.

But if filmmaking is a model, it is well to consider that films are often plagued by temperamental personalities prone to walkouts and by prodigious egos prone to bullying. Joy Mountford's interaction design teams at Apple Computer included everyone from former CIA agents to punks with pierced nipples. Not surprisingly, she concludes: "You can't make an algorithm to figure out team building."

Irene McWilliam, interaction design manager at Philips in Eindhoven, the Netherlands—where the permanent interaction design team includes software engineers, human-factors specialists, and behavioral psychologists, as well as designers of various kinds—tries to bridge professions by encouraging people with one skill to develop the secondary skill that most interests them. A print-based graphic designer might learn how to produce high-quality screen-based graphics, for example. Not only is understanding enhanced, but it becomes possible to assemble interaction design teams covering all the skills needed on a project using fewer people.

The willingness of a large, established company like Philips to make interaction design a core part of product development may hint at the important role this new convergence of skills will come to play in the creation of tomorrow's products. When interaction design becomes a routine part of the development process—as accepted as engineering design and market research—then we can expect electronic products to become not only more sophisticated but also easier and more pleasant to use. ■



TECHNOLOGY UPDATE

900 MHz breakthrough!

New technology launches wireless speaker revolution...

Recoton develops breakthrough technology which transmits stereo sound through walls, ceilings and floors up to 150 feet.

by Charles Anton

If you had to name just one new product "the most innovative of the year," what would you choose? Well, at the recent *International Consumer Electronics Show*, critics gave Recoton's new wireless stereo speaker system the *Design and Engineering Award* for being the "most innovative and outstanding new product."

Recoton was able to introduce this whole new generation of powerful wireless speakers due to the advent of 900 MHz technology. This newly approved breakthrough enables Recoton's wireless speakers to rival the sound of expensive wired speakers.

Recently approved technology. In June of 1989, the *Federal Communications Commission* allocated a band of radio frequencies stretching from 902 to 928 MHz for wireless, in-home product applications. Recoton, one

of the world's leading wireless speaker manufacturers, took advantage of the FCC ruling by creating and introducing a new speaker system that utilizes the recently approved frequency band to transmit clearer, stronger stereo signals throughout your home.



150 foot range through walls!

Recoton gives you the freedom to listen to music wherever you want. Your music is no longer limited to the room your stereo is in. With the wireless headphones you can listen to your TV, stereo or CD player while you move freely between rooms, exercise or do other activities. And unlike infrared headphones, you don't have to be in a line-of-sight with the transmitter, giving you a full 150 foot range.

The headphones and speakers have their own built-in receiver, so no wires are needed between you and your stereo. One transmitter operates an unlimited number of speakers and headphones.



Recoton's transmitter sends music through walls to wireless speakers over a 70,000 square foot area.

Crystal-clear sound anywhere.

Just imagine listening to your stereo, TV, VCR or CD player in any room of your home—without running miles of speaker wire. Plus, you'll never have to worry about range because the new 900 MHz technology allows stereo signals to travel distances of up to 150 feet through walls, ceilings and floors without losing sound quality.

A single transmitter, unlimited receivers.

The powerful transmitter plugs into an audio-out, tape-out or headphone jack on your stereo or TV component, transmitting wirelessly to speakers or headphones. The speakers plug into an outlet. One transmitter broadcasts to an unlimited number of stereo speakers and headphones. And since each speaker contains its own built-in receiver/amplifier, there are no wires running from the stereo to the speakers.

Full dynamic range.

The speaker, mounted in a bookshelf-sized acoustically constructed cabinet, provides a two-way bass reflex design for individual bass boost control. Full dynamic range is achieved by the use of a 2" tweeter and 4" woofer. Plus, automatic digital lock-in tuning guarantees optimum reception and eliminates drift. The new



Breakthrough wireless speaker design blankets your home with music.

technology provides static-free sound in virtually any environment. The speakers are also self-amplified; they can't be blown out no matter what your stereo's wattage.

Stereo or hi-fi, you decide. These speakers have the option of either stereo or hi-fi sound. Use two speakers (one set on right channel and the other on left) for full stereo separation. Or, if you just want to add an extra speaker to a room, set it on mono and listen to both channels on one speaker. Mono combines both left and right channels for hi-fi sound. This option lets you put a pair of speakers in the den and get full stereo separation or put one speaker in the kitchen for hi-fi sound.

Factory-direct savings. Our factory-direct pricing allows us to sell more wireless speakers than anyone! For this reason, you can get these speakers far below retail with our 90-day risk-free home trial."

Add headphones and save \$100. For a limited time, when you order two speakers and a transmitter, you can add wireless headphones



for only \$49. That's a savings of \$100 off the price of the headphone system. This exclusive offer is available only through Contrad. Your order will be processed within 72 hours and shipped UPS.

AWARD WINNING WIRELESS SPEAKER

Built-in receiver and amplifier:

The wireless speaker and headphones both contain a built-in receiver and amplifier. Signals are picked up and transmitted as far as 150 feet away through walls without the use of wires.



Volume Power Tuning Tuned ports
2" tweeter
4" woofer
Individual left, right & mono switch and individual bass boost control (on back)
Size: 9"H x 6"W x 5.5"L
Signal-to-noise ratio: 60 dB
Channel Separation: 30 dB
Two-way bass reflex design
10 watts/channel RMS amps
Frequency Response: 50 Hz-15 KHz

Don't take our word for it. Try it yourself. We're so sure you'll love the new award-winning Recoton wireless speaker system that we offer you the **Dare to Compare Speaker Challenge**. Compare Recoton's rich sound quality to that of any \$200 wired speaker. If you're not completely convinced that these wireless speakers offer the same outstanding sound quality as wired speakers, simply return them within 90 days for a full "No Questions Asked" refund.

Recoton's Design and Engineering Award



Recoton transmitter.....\$69 \$7 S&H
Recoton wireless speaker\$89 \$9 S&H
Wireless headphone system.....\$149 \$9 S&H
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MITnews

FROM THE ASSOCIATION OF ALUMNI AND ALUMNAE OF MIT FEB/MAR 1996

Community Service— *It's a Trend*

BY LISA WATTS

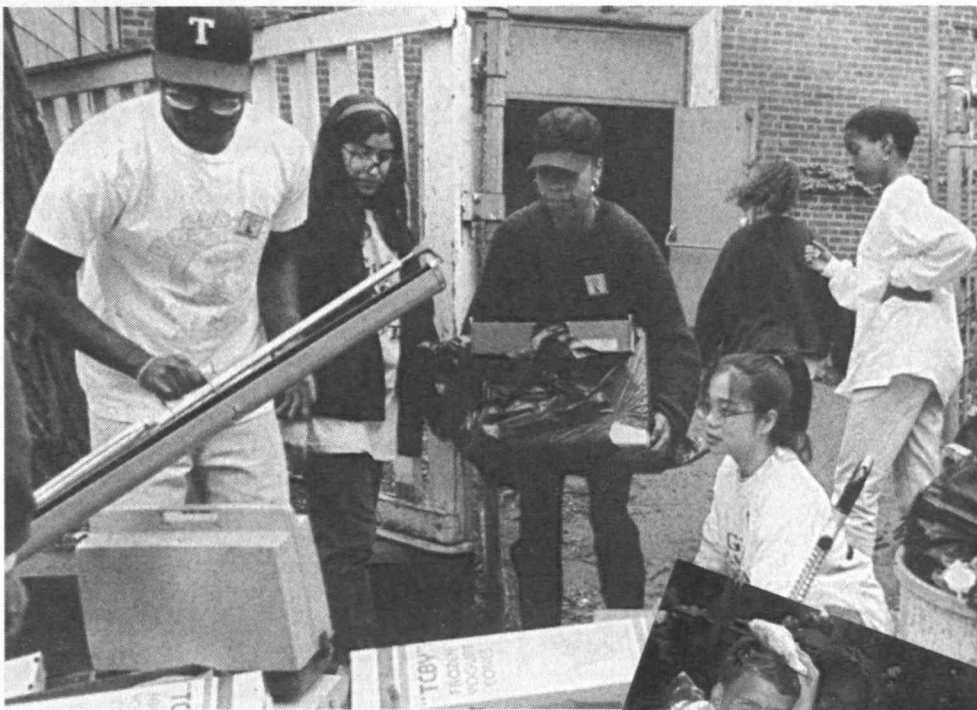
As a freshman, Gwendolyn Lee, '95, felt lucky to be at MIT. But something was missing from her experience. She found it when she designed and taught an after-school science enrichment class to a group of Cambridge middle-school students.

The students learned, for example, how to build their own small radios from odd parts, and Lee says she learned an important new concept. "Volunteerism was not really part of my native language growing up in Taiwan," she says. "But I knew that I wanted to be a good person as well as a strong engineer."

Lee, now a master's candidate, has continued to give of her time to teach more classes, tutor youngsters, and to coordinate the CityDays Festival, a day-long fall program with a cast of hundreds.

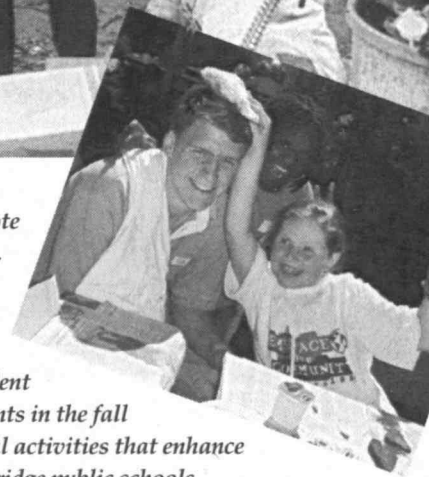
Lee joined a panel of fellow student volunteers in October speaking to members of the Emma Rogers Society, an association of women whose late husbands were alumni or faculty of MIT. The speakers represented the work of MIT's Public Service Center (PSC), a clearinghouse begun in 1988 to match willing students with programs or needs in the surrounding communities. Host for the gathering was Priscilla Gray, who was one of the founders of the PSC and is co-chair of its steering committee.

Not surprisingly, many of the center's activities are focused on the Cambridge school system and its students, and the primary vehicle is CityDays: A Two-Way



THE VOLUNTEER SPIRIT OF MIT STUDENTS

was in evidence—as well as their readiness to promote healthy race relations—when members of Sigma Chi, the Black Students Union, the Korean Students Association, and McCormick Hall planned a day of painting, collecting trash, and yard work at the Cambridge Community Center. Right: This MIT student and his new friend were among some 1,300 participants in the fall CityDays Festival on campus, the highlight of annual activities that enhance science and math education for children in the Cambridge public schools.



Street, a year-long, multifaceted program. The showcase event is the festival during R/O week, which in 1995 brought fourth-, fifth-, and sixth-graders to campus to be matched with 900 undergraduates and graduate students for a day of games, tours, and lunch. A program dubbed CityDays/LINKS, carries the festival's momentum through the year by enlisting MIT students to work for one to three hours per week in K-12 classrooms and afterschool programs. There were 240 LINKS volunteers, for example, during the spring 1995 semester.

Other PSC projects include a campus science expo for middle-schoolers, a blanket and coat drive for the needy, and a kick-off breakfast for the annual Walk for Hunger in the Boston area.

Emma Rogers Society members expressed amazement at how the college students keep so many activities on their plates while also managing their academic work. Emily Sandberg, now in her second year as director of the PSC, introduced five of her volunteers by listing a few of the demands on their time—a number of the students also participate

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Traditional Communication

"Polybagged" with your copy of the January issue of Technology Review, you should have received a copy of Charles Vest's Report of the President for 1994-95. In a climate where, of necessity, research universities and other educational institutions must focus so intently on their bottom lines and their past track records, President Vest made a conscious effort to open a discussion on a more exhilarating plane. His focus was on some of the unanswered questions that fascinate academic researchers and drive their best efforts. By presenting the report to alumni/ae as a stand-alone document, we hope we made it easier for you to save the report or pass it on to a friend or colleague. Even in the age of the Internet and the World Wide Web, the best kind of communication is still from the hand of one thoughtful reader to another.—SUSAN LEWIS



on varsity teams and serve in fraternities and sororities. In spite of their heavy academic and extracurricular workloads, however, several say that their experiences in the schools were so positive that they are considering careers in education.

One source of pressure that MIT has been able to ameliorate is the need for students to hold part-time jobs during the year to meet the requirements of their financial-aid packages and pay their personal expenses. Every year during the Independent Activities Period (IAP) in January, the community work of 15 students is supported through fellowships funded by the Germeshausen Foundation, which also underwrites summer projects for an additional 3 students.

Jon Allen, '96, worked as one of the center's paid fellows last summer. His work included a week-long seminar with seventh-, eighth-, and ninth-grade teachers to make the Cambridge science curriculum more sequential from one grade to the next; another week with kindergarten through sixth-grade teachers on ways to improve the presentation of science concepts; and a month's work on creating a "Principles of Science" course for ninth graders. Allen admits he is somewhat surprised to find that his experiences are leading him to consider a master's in education to become a teacher.

Keith Bevans, who expects to receive both bachelor's and master's degrees in electrical engineering in June, has also seen his long-range career goals evolve. Bevans got involved with the PSC in his sophomore year, when he agreed to coordinate a TEAMS (Technology and Engineering for the Advancement of Minority Students) project launched

under the auspices of the MIT chapter of the National Society of Black Engineers. TEAMS exposes Cambridge middle-school students to work in science and engineering through a series of Saturday classes, on campus, over a nine-week period. Bevans later served a one-month fellowship in area schools during IAP.

Bevans is doing a master's thesis on improving the use of computers in the Cambridge science curriculum. "My lab will be the classroom, not sitting in front of an oscilloscope somewhere," he said. "That's not something I ever imagined would happen." In the fall, he was interviewing with management consulting firms, but Bevans hopes eventually to work in educational development.

Volunteer work also gives students leadership opportunities. Shruti Sehra, '96, helped organize the Giving Tree, a joint project of the service center and the Panhellenic Association. The 1994 effort collected 1,084 holiday gifts, valued at more than \$10,000, for underprivileged children in Boston and Cambridge. As a current intern in the PSC, Sehra is organizing a women's week on campus this spring to address issues of women's health and empowerment.

Other projects presented at the Rogers Society session included KEYS, the student-led program for 11- to 13-year-old girls in the Greater Boston area. The program brings girls to campus for one or two days and links them with an undergraduate, graduate-student, or staff mentor who can encourage their interests in science and engineering. The mentors set up group and individual activities ranging from the sublime to the prosaic—among them a visit to a local service station to learn how to change a car tire. After a day on campus, one of



The youngsters at left are participants in KEYS, an MIT program of science and technology workshops on campus specifically geared to 11- to 13-year-old girls from the Cambridge schools. Last fall, student activists discussed KEYS and other volunteer-driven community projects with some of their biggest fans: the leaders and supporters of the MIT Public Service Center and the members of the Emma Rogers Society. From left above: Audrey Kuang, '96; Polly Germeshausen, a trustee of the Germeshausen Foundation; Keith Bevans, '96; Priscilla Gray, co-director of the PSC Steering Committee; and Carrie Metzger, '97.

their excited participants reportedly told her mother, "I never knew there were other girls like me."

Tracy Desovich, a member of the MIT Medical Department, introduced

during the October panel a handful of the almost 100 students she has trained to serve as volunteer health educators, called MedLINKS. Desovich's recruits instruct their fellow students in MIT

dormitories and living groups on where to turn for health information and medical care.

The student volunteers were honest about their public service work, noting that many times they had little idea what they were getting into when they took on an assignment. Gwendolyn Lee says her biggest challenge in teaching was discipline, having been educated in Taiwan, where students don't put their feet on the table or speak back to teachers. She also found that she had to work at striking a balance between focusing on math and science and giving the big-sisterly advice on popularity and friends that middle-school students seem to crave.

Lee says volunteering has become a way of life for her now, even as she juggles her graduate-school responsibilities. "I have learned that I can take just a small amount of my time and really make a difference in some people's lives," she says.

After thanking the student speakers, Priscilla Gray turned to the Rogers Society members: "The next time you hear that the world is going to hell in a hand-basket," she said, "remember what you have heard here." □

TECH WEEK & Reunions '96

June 6-9, 1996



Save the Dates, Book Your Rooms!

➤ **TECH NIGHT AT POPS: Thursday, June 6**

➤ **LAB TOURS & OFF-CAMPUS TOURS**

(& COMMENCEMENT): Friday, June 7

➤ **TECHNOLOGY DAY: Saturday, June 8**

➤ **TECHSAS BBQ AND TECH CHALLENGE GAMES: Sunday, June 9**

Watch your mail or call
(617) 253-8203 for information.

Solar Triumph

It was a treat for local alumni/ae when Golden, Colo., was named the end point of Sunrayce '95, a 1,150-mile solar-car race that started in Indianapolis last June. That gave members of the MIT Club of Colorado ringside seats for the triumph of the *Manta*, the pride of the Institute's Solar Electric Vehicle (SEV) Team.

Driven by graduate student Goro Tamai, '93, SM '95 (II), the *Manta* finished the nine-day event with a racing time of 33:37:11, at speeds sometimes exceeding 60 mph. The car, which is powered by solar cells that charge 300 pounds of off-the-shelf lead-acid batteries, came in barely 19 minutes ahead of the University of Minnesota entry, for the closest finish in event history. "The main reason we won," observed Hao Chien, '96 (VI), "was because our car was extremely reliable. We didn't even have a flat tire," a common problem for other racers. They also got a boost from a number two starting position, the result of good showing on the pre-race qualifying run.

The car is entirely the work of the 30-member student team, from design and construction to finding sponsors. Writing for the *Tech*, Daniel Stevenson, '97, reported that thanks to a heavy investment of sweat equity, the team was able to build the *Manta* for only about \$70,000, some two-thirds of which

Manta, designed and built by the MIT Solar Electric Vehicle Team and so named because its sleek profile conjures up the image of a manta ray, beat 37 college teams to win Sunrayce '95.

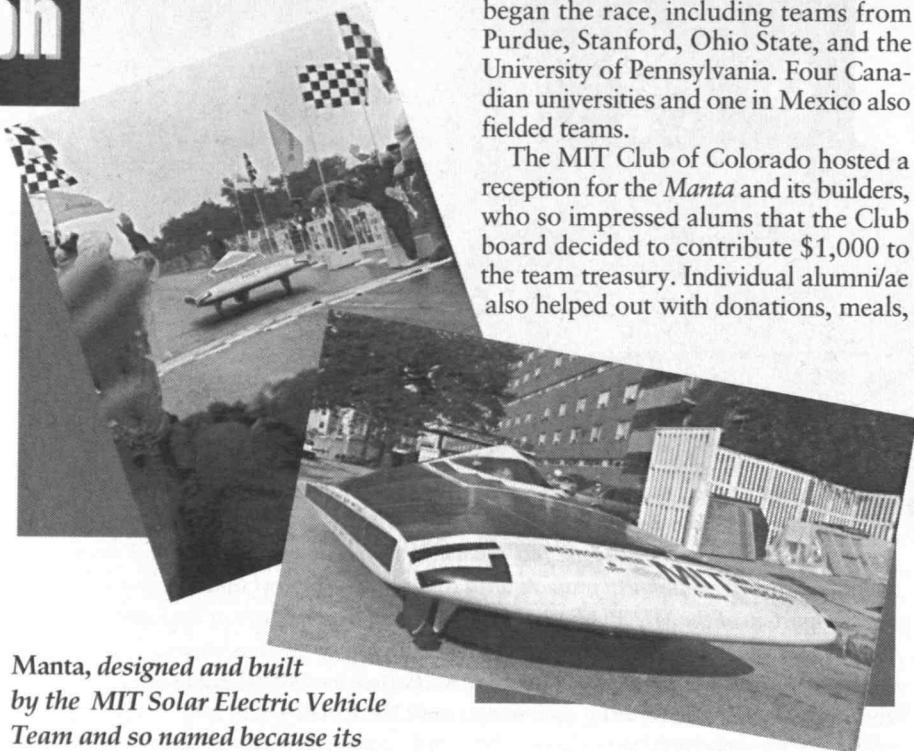
came from corporate sponsors, with the remainder from MIT. By contrast, Stevenson noted, the defending champion University of Michigan team spent \$1.4 million on its car, which didn't make it to the finish line. Most teams spent several hundred thousand dollars on their entries, noted team member Matthew Condell, '96. Thirty-eight cars

began the race, including teams from Purdue, Stanford, Ohio State, and the University of Pennsylvania. Four Canadian universities and one in Mexico also fielded teams.

The MIT Club of Colorado hosted a reception for the *Manta* and its builders, who so impressed alums that the Club board decided to contribute \$1,000 to the team treasury. Individual alumni/ae also helped out with donations, meals,

and accommodations along the way.

Sunrayce is a biennial event sponsored by the U.S. Department of Energy and General Motors to promote student interest in technology and the environment, and the MIT team will need continued outside support if it is to stay competitive. Fund-raising for the team is coordinated by Diana Buttz, '98, c/o MIT SEV Team, Rm. 20D-007, 77 Massachusetts Ave., Cambridge, MA 02139; (617) 253-6140; <dcbutt@mit.edu>. □



FYI



MIT GAMESMAN APPEARS AT LINCOLN CENTER
Readers of MITnews who remember seeing an article about Gamelan Galak Tika in the October 1994 issue ought to be suitably impressed that the fledgling group was invited to perform in an eight-hour

adventurous collection of students, staff, and members of the local community, augmented by performers on electric guitar and synthesizer, received a "tumultuous standing ovation," as noted in no less a source than the *Village Voice*.

modern-music marathon at Lincoln Center in New York City last spring. Founded by Evan Ziporyn, Class of 1958 Professor of Music, more than two years ago, Gamelan Galak Tika performs traditional Balinese music and many of Ziporyn's own compositions. This musically

Out with the Old, in with . . . What?

In November, Hong Kong businessman Gordon Wu announced a \$100 million gift to the engineering school at Princeton University, his alma mater. He explained that he was focusing his philanthropy on an elite American university rather than on a school in Asia, where he had built his family's billion-dollar fortune, because of the importance of supporting centers of excellence wherever they exist in the world.

John Loeb, the Wall Street financier who announced a \$70 million gift to Harvard University last year, used similar logic in explaining why he was leaving the bulk of his family's fortune to that wealthy university.

At a time when the federal government is cutting back on financing for academia, many large private donors are reaffirming the need to maintain the excellence that characterizes higher education in America. It is an excellence that has survived even in the face of growing problems in primary and secondary education across the country, problems that have left so many schoolchildren at a disadvantage when compared with their peers in Japan, Korea, France, and other nations. But it is an excellence that should not be taken for granted, and one that comes at considerable cost.

That excellence is not just happenstance. It comes in part from the inspiration and work of individuals who are driven to build and nurture centers of higher learning. But from the early days of the colonies, government, too, has played a critical role in supporting those efforts in a true public-private partnership.

As Lester M. Salamon points out in his recent book, *Partners in Public Service* (Johns Hopkins University Press), colonial governments established a tradition of assistance to private educational institutions that dates back well before the American Revolution. Massachusetts levied a special tax to support Harvard and paid part of the salary of its president until 1781. Connecticut provided similar support for Yale.

As the times changed, so did the model for supporting higher education



in America. After the Civil War, for example, Congress passed the Morrill Act, establishing in each state land-grant universities aimed at making education available to children of the working class. (MIT is a land-grant college, and the governor of Massachusetts still sits, ex officio, on the MIT Corporation.)

After World War II, the G.I. bill sent returning veterans to college, filling university classrooms and creating a generation of educated workers and leaders who made great contributions to the growth of post-war America. In the 1960s and '70s, new student-aid programs helped bring high-quality college educations within reach of bright students with fewer means.

It was Vannevar Bush, '16, an MIT engineer and science advisor to Franklin Roosevelt, who largely shaped the models after World War II by which America as a nation would support research and higher education endeavors for the next 50 years. He was in a unique position: As an educator, he understood the needs of universities and their workings; as a government advisor, he understood how to formulate and win support for government policy.

As each era has brought its own challenges, this country has found ways to tailor public support for higher education to meet them.

Now we are at the next crossroads. We have entered what we hope is a sustained period of peace. The need for first-class educational and research institutions is as great as ever. But despite discussions like the one by Professor Harvey Sapolsky of MIT and Congressman George E. Brown, Jr., in the November/December issue of *Technology Review* on the case for supporting those institutions and their work, the rationale now seems less obvious to many. No plan has surfaced that has won public backing, nor is there an obvious author at hand—a new Vannevar Bush.

Maybe it is a task worthy of a blue-ribbon commission—a thoughtful body of people from education and industry, government and the private sector, who could not only envision a new approach but could also build public consensus behind it. What we have now in Washington is an attempt to hack away at the existing system, without any clear vision about what might take its place.

There is unquestionably broad public sentiment for reining in government and reducing its financial commitments. But at a time like this, it is all the more important to weigh the value of higher education and its special role as an investment in future growth for the nation—and the world. If the old models for government collaboration with the research universities have outlived their usefulness, we must focus explicitly on devising new models.

In the meantime, colleges and universities will have to scramble to do more with tuition, gifts and endowment, and other earnings to replace the government money they lose. They may also have to pare their own activities: to educate fewer students, to focus their research missions more tightly. And they will have to rely more than ever on the good will and largesse of donors like Mr. Wu. □

Karen Arenson

KAREN WATTEL ARENSON, '70,
President, Association of
Alumni and Alumnae of MIT;
<dubm13d@prodigy.com>

ClassNotes

20

Erwin Harsch of Belmont, Mass., died June 30, 1995, and is survived by a daughter, Mary Harsch of Belmont. He had just celebrated his 100th birthday on April 23.

Please send news for this column to: Class Notes Editor, *Technology Review*, MIT W59-200, 77 Mass. Ave., Cambridge, MA 02139

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75th Reunion

We have a delightful long letter from Anne (the superb artist) and John Mattill (superb editor emeritus of *Technology Review*) extolling the virtues of attending the 75th anniversary of the Class of 1921 in Cambridge during Technology Week in June.

Much as the mind is in full agreement, getting the old bones to supply adequate locomotion is a dubious risk. Regretfully, we have not been deluged by reservation requests for the special luncheon.

So please tell us now (by phone or letter) dear reader, if you want one or more seats around the table or if you will definitely pass the celebration.

Mike was a good friend and student; even-tempered, always with a grin and humorous bit to relieve the day's tension. On MIT records as M. Harry Naigles, engineering administration, it is our great sorrow to report that he died at home on September 25, 1995, at age 96. Sadly we extend sincere sympathy to his surviving family, which includes his wife, a daughter, and two grandsons.

Mike had invented a process to affix fiberglass cloth to Douglas-fir laminated diving boards to hold nonslip grit and significantly prolong life of the wood. He founded the Dolphin Swimming Pool Co. of Elmsford, N.Y., to supply these diving boards along with every conceivable accessory for pools—mountings, lights, tiles, cleaners, chemicals, ladders, safety alarms, and enough more to fill a detailed and attractive 50-page catalog.

A native of Dorchester, Mass., he prepared for MIT at Boston Public Latin School. At the Institute he was a member of Zeta Beta Tau fraternity and VP of the Menorah Society.

As we go to press, our own family is celebrating the arrival of our first great-granddaughter, Jessica Marie Charron, on September 23, 1995. We continue to enjoy and observe very creative efforts, interest in scientific fields, and computer facility of our great-grandson, Ian Joseph Shinnerberger, a second-grader who may be headed for MIT some day!

We beg you to tell us your plans for the June event and to give us some news for this column. Our sincere thanks for your help.—Carole A. (Cac) Clarke, president and secretary, 608 Union Ln., Brielle, NJ 08730-1423; tel: (908) 528-8881

22

We report the death and celebrate the life of William B. Elmer, who died last September 5 in Jourdan, Tex. An inventor and innovator, he held more than 40 U.S. and

foreign patents. After receiving an SM degree from MIT in electrical engineering, he worked for Boston Edison Co. for 20 years in electrical transmission, distribution, and operation. While there, he originated the basic metal head for streetlights. He then spent four years at Westinghouse Electric Corp, where he worked as a project engineer to design a homing-type torpedo mine used in WWII. Top secret during those years, the "Mark 12" later won Elmer a Department of Defense special award.

Also among his accomplishments, Elmer designed the reflector light for the walking-stick camera used by Neil Armstrong during the Apollo 11 mission to the moon and the "Sun Gun," a mobile, hand-held photographic light for use in Hollywood productions that won an Academy Award in that year's technical category. He wrote *The Optical Design of Reflectors*, now in a third printing. He was also a registered tree farmer in New Hampshire, a charcoal portraitist, a fine pianist who composed over 30 classical piano works, and a restorer and decorator of mechanical clocks.

From the Late Fall '95 issue of *Voo Doo* magazine in an article written by Larry Appleman, '76, we learn that William Elmer was a founder of this college humor magazine in 1921. It seems one June day a few years back "a nattily dressed elderly gentleman" visited the *Voo Doo* office curious about the current state of the magazine—he wanted to see what today's students consider funny. The staff was skeptical ("At first we thought he was one of those creepy old people who like to associate with college kids.") But soon Elmer began sending them his own elaborate pen-and-ink renditions (such as the illustration on this page) and inviting staffers to his home in Andover to see "old issues."

"We soon began a regular correspondence with Mr. Elmer, sending him each new issue of *Voo Doo*, and he'd often respond with words of encouragement. A couple of years ago he wrote, 'Now I know that Tech still gathers into its fold the cream of America's

A recent cover of *VooDoo* magazine, drawn by the founder, William Elmer, '22.

youthful products.' Nothing we printed ever seemed to shock or distress Mr. Elmer. . . . When we heard that William B. Elmer passed away in September, our thoughts ran back to that June day years ago when he found his way to our office."

Our sympathy goes to Mr. Elmer's wife of 42 years, Cathleen Burns, three sons, a brother, nine grandchildren, and four great-grandchildren.—Ed.

Please send news for this column to: Class Notes Editor, *Technology Review*, MIT W59-200, 77 Mass. Ave., Cambridge, MA 02139

23

Good news today—no deaths to report. Following is the third list of names of classmates who, according to my records, are living. If you know otherwise or have any news, please

write me and give details. William A. Peabody, Roger E. Phelps, R. Francisco Ravella, Jr., A. De Wit C. Redgrave, Edward C. Rue, Luis Ruiz De Luzuriaga, Lawrence D. Schmidt, Joseph H. Scholtz, Jr., Howard V. Shipley, Erling Skabu, Phillip C. Smith, R. Morris Falk, R. Jorge E. Ferreyra, John Flaherty, Roland W. Frieder, Harold B. Gray, William C. Gray, Harry Green, David Grelick, George H. Hewett, R. Keizo Horiuchi, Luis A. Igartua, Alfred Ihlen, David B. Joy, Finn Kuhnle, Bernard Lewes, Lewis E. Lyon, James A. McDonough, Isbell F. McIlhenny.—Royal Sterling, secretary, Apt. D201, 2350 Indian Creek Blvd. W., Vero Beach, FL 32966-5103

24

A note from the Alumni/ae Association tells of the passing of classmate Emmons Wentworth Blodgett, May 24, 1995, in Mediplex of Stamford, Conn. He had been a



member of the Greenwich Representative Town Meeting, was past president of the Greenwich Audobon Society, and had been active with the Bush-Holley House historical organization in Greenwich. Mr. Blodgett is survived by his wife, Helen Boswell Blodgett, of Stamford; a son, Lawrence W. Blodgett of Cincinnati, Ohio; two daughters, Cynthia B. Martin of Summit, N.J., and Victoria Blodgett of Sedona, Ariz.; five grandsons; and eight great-grandchildren.

The family requests that memorial contributions be made to Planned Parenthood, 810 7th Ave., New York, NY 10019, or to the Greenwich Audobon Society, P.O. Box 7487, Greenwich, CT 06836.

The rain finally stopped but not before we were flooded out. I only had six inches of water in my apartment—many had several feet. We were out for six months and it all was harder on others than on me, fortunately. The plus side to all of this was that we all have new walls, floors, carpeting, paint, and brand-new appliances. New refrigerators, new stoves, new microwaves, dishwashers, furnaces, etc. One can not get too upset with all of that. My camellias loved all that water and are flourishing.—Co-secretaries: Colonel I. Henry Stern, 2840 S. Ocean, #514, Palm Beach, FL 33480; Katty Hereford, 237 Hacienda Carmal, Carmel, CA 93923

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Don Taber, our VP received an SB in business and engineering administration, Course XV. After graduation, his father took him on a five-week tour of Europe.

When he returned, he went to work for Estabrook & Co., investment bankers in Boston. In March 1929, Don started to work at American Pad and Paper Co. in Holyoke, Mass., and 45 years later he retired. He became general manager in 1938. Under his leadership, sales increased 40 times with profits every year. A profit-sharing plan paid as much one year as 45 percent of annual pay for every employee. Stockholders fared even better.

Don's many community activities included being president and director of the Holyoke Public Library and the United Way of Holyoke. Also, he was director of two banks, the YMCA, the Children's Services and the Holyoke Hospital. In 1967, he was the recipient of the William Dwight Award for Distinguished Public Service.

Don's first wife, Ida, lived to their 52nd anniversary. With his second wife, Billie, they are enjoying their 12th year. Don has two daughters and a son, six grandchildren and three great-grandchildren.

The passing of two classmates must be reported. **Russell A. Cowles** died in Birmingham, Mich., on November 11, 1994. The only information available shows that in 1955 he was technical director of Difco Labs, Inc., in Detroit. By 1976 he was retired. . . . **Leonard Connott** died on April 13, 1995, in Metairie, La. In 1955, he was president and owner of Piston Ring Service Co. in New Orleans. By 1984 he was retired. He is survived by his wife, Elizabeth Connott.—F. Leroy "Doc" Foster, secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

26 70th Reunion

We regret to report the deaths of the following classmates:

George E. Armington of

Austinburg, Ohio, on February 17, 1995; **Ernest Clifford Van Blarcom** of Washington, D.C., on June 1, 1995; **George A. Morton** of Walnut Creek, Calif., on May 15, 1995; **Thomas M. Rowlands** of Honolulu, Hawaii, on November 4, 1994.

George Armington received a master's degree from MIT after only one year of study. He was a longtime Cleveland area industrialist and an aeronautical engineer for Glenn L. Martin Co. before joining his brothers in the family manufacturing business, Euclid Road Machinery Co., as head of engineering and factory manager. In 1953, the company was purchased by General Motors Corp. George was retained as director of engineering, serving three Euclid division plants. After retiring from GM, he became chairman of the board of Euclid Crane and Hoist Co., a company founded by his father in the early 1920s. He is survived by his wife, Helen, whom he married in 1927; a daughter, Marjorie Armington; eight grandchildren; and four great-grandchildren.

Ernest Van Blarcom, while a student at MIT, married Lorna Leona Shaw of Portland, Maine, on August 13, 1924. He was employed by the Atomic Energy Commission in Washington, D.C., and was involved in the processing of uranium ore. He retired from the AEC in 1969, but continued to live in Washington.

George Morton studied electrical engineering and physics at MIT, where he received a PhD in 1932. He published dozens of scientific papers and co-wrote two books—*Television*, which was translated into several other languages, and *Electron Optics and the Electron Microscope*. His family is proud of his distinguished contributions in electronics, optics, and many other fields. Morton is survived by his wife, Lucy; four children; a sister; and a granddaughter.

Unfortunately, we have little information about Thomas Rowlands. He predeceased his wife, Helen.

Please send news for this column to: Class Notes Editor, *Technology Review*, MIT W59-200, 77 Mass. Ave., Cambridge, MA 02139

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In a previous issue, we reported the death of **John Wesley Harris** of Natick, Mass., on May 3, 1994, and I am pleased now to summarize his life as provided by his son,

Donald Harris, of Millis.

He was retired from Metropolitan Moving & Storage Co., Cambridge, where he was VP and director over the course of a 40-year working career. This company owned and occupied the huge brick landmark building diagonally opposite MIT's aeronautical building on Mass. Ave. There are over 1,500 individual, airtight, fireproof rooms of varied size in this building built before MIT arrived in 1916.

Wes was a lifetime member of the Transportation Club of New England and past president of the Massachusetts Chapter of the American Baptist Men's Association. In 1993,

ClassNotes

he was given the title of Honorary Lifetime Deacon by the First Baptist Church in Natick having joined in 1928 and served in every capacity.

Wes shall always be remembered for his quick smile, his patience, the many books and magazines he was always reading, and the love he had for his family. Besides his wife, Edith, he leaves three sons, one daughter, 12 grandchildren and seven great-grandchildren.

We send our sympathy to his wife and family.—**Joseph C. Burley**, secretary, 1 Harbour-side Dr., Delray Beach, FL 33483; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06405

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While we treasure the presence of all of our classmates even though it is expected that as we advance in years there will be attrition of our numbers, there will always be

those who by the long commitment of their lives and work have earned our highest respect. Such is the feeling of sorrow and honor at the death of **Florence Joep Smith** on Saturday September 9, 1995, at her home at the Carleton-Willard Village in Bedford, Mass., where she had been a resident for two years after suffering a stroke in 1993.

Her life was a continuum of work and companionship for our Class of 1928 and MIT with two other honored members, as wife of **Ralph Theodore Joep** and **Walter Joseph Smith** who predeceased her in 1965 and 1990.

Her thoughts and endeavors were further devoted to her family, home, church, charities, honor societies, and friends who benefited through the years by her interest and compassion. This was manifest in the extent and nature of the recognition and awards from the many sources responding throughout her life, which climaxed at a high tea following a memorial service at the Epiphany Episcopal Church in Winchester, Mass., on October 9, 1995. With a feeling of inadequacy to fully express this loss, we will be forever reminded of her exemplary attributes.

In addition to the death of Florence, we regret to report the passing of two other members of our Class of 1928. **Joseph Armand Monier, Jr.**, on February 10, 1995, and **Austin Robinson Caverly** on March 17, 1995. "Monnie" Monier spent his lifetime of work in many capacities, including the Atomic Energy Manhattan Project, with E.I. Dupont de Nemours & Co. "Cav" Caverly devoted 66 working years with the Aluminum Co. of America and was active in the administration of the MIT Scholarship Fund.

As Class Notes secretary, I am assuming it acceptable to write of myself lacking information on activities of others. As a rider of high wheel bicycles for almost 70 years and a founding member of The Wheelmen, a group devoted to the restoration and use of antique cycles, I had the pleasure of participating in a three-generation ride in August 1995 at Owls Head, Maine, with my sons David and Paul and my grandsons Eric and Christopher. I



ERNEST KNIGHT, '28

enjoyed the further satisfaction of riding the high wheeler I have used since 1933 at a gathering of Wheelmen from all over New England and the East Coast held in Portland, Maine, for my 90th birthday. Participation in crew while at MIT before undertaking antique bicycles has provided incentive to assure an active lifetime that hopefully continues through old age, probably better with both feet on the ground.—**Ernest H. Knight**, secretary and president, 168 Ai Plummer Rd., Raymond, ME 04071-6349

29 Richard E. Bolton of Westmount, Quebec, writes, "At age 88, one's activities are somewhat limited. Although retired for nearly 20 years, I still manage to do a bit of architecture for friends and family and to study the development of architecture and city planning. In recent years I have written a bit of family history and helped to write a history of civil engineering in the Royal Canadian Navy." He has also recently become a great-grandfather for the first time. *Congratulations, Richard!*

We unfortunately have three deaths to report: **Kenneth D. Beardsley**, of Springfield, Mass., on March 24, 1995; **Jonathan F. McCray**, of Bel Air, Md., on July 4, 1993; and **Bradford W. Thompson**, of Duxbury, Mass., on December 13, 1994.

We do not have much information on any of these gentlemen, but we want to send our deepest sympathy to the families.

Please send news for this column to: Class Notes Editor, *Technology Review*, MIT W59-200, 77 Mass. Ave., Cambridge, MA 02139

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Angelo "Ric" Ricciardelli reports that he and Jane spend quite a bit of time visiting their six children who live as far away as Anchorage, Alaska, a substantial distance from their home base in Charlottesville, Va. Ric still reads Italian literature and "plays golf in earnest to shoot my age," an objective that very few of our survivors can hope to achieve. In my own case I would have to remain physically active to age 115 to reach this goal. Ric still keeps in touch with **Harvey Chapman**, with whom he did a Course VI thesis many years ago, although in recent years their principal contact has been by telephone.

Barnet Rosenthal reports from Tamarac, Fla., that prior to the spring of '91 he and Charlotte led quite an active life, participating in local and Temple affairs and enjoying golf, bridge, theater, and dances. However during the last four years Charlotte has developed some serious health problems. While Barnet's health is good and he still drives a car, he spends much of his time caring for Charlotte. As of the time he wrote, the Rosenthals were looking forward to celebrating their 60th wedding anniversary in December '95.

During August and September of '95, we lost four more of our classmates: **Fred Garvin** on August 3, **Ben Buerk** on August 23, **Tony Savina** on August 29, and **Ted Riehl** on September 27.

From the time he graduated until his 1978 retirement, Fred worked for the Boston Public Works Dept. He began his career as a design draftsman and civil engineer. In the 1940s and 1950s he designed and engineered the development of surface and tunnel systems for the East Boston transit lines. He later became division engineer and chief engineer of public improvement in Boston, and deputy commissioner of public works in the years before his retirement. As deputy commissioner he supervised the output of the Engineering Division, which is the service division for all other Public Works Departments, i.e., Highway, Sewer, Water and Lighting Depts. Fred's wife, Margaret, died in 1980 and several years ago he had a stroke. Thereafter he lived in an apartment in the home of his daughter Jean in Reading, Mass. In addition to Jean he is survived by a second daughter, two sons, and five grandchildren.

Ben Buerk was a native and lifelong resident of Buffalo, N.Y. After graduating from MIT, he attended Harvard Business School before joining the family business, Buerk Tool Works. During World War II he helped to establish the National Tooling and Machining Association, which trained toolmakers and machinists to manufacture war materials and to replace a work force engaged in fighting the war. He also developed an interest in aircraft manufacturing and converted his business into an aerospace supplier, doing business with Curtiss-Wright Corp. and the Republic and Bell Aircraft Companies. He built a small part for the LEM, which is still up on the moon. (His wife, Bernice, suggests that this might entitle him to be called a "lunar litter bug.") During the latter part of his career he toured the Soviet Union and, under the aegis of the National Tooling and Machining Association,

attended a conference on international quality standards in Brussels, Belgium. Ben was a life member of ASME and of the Society of Manufacturing Engineers, as well as a life member and past master of the Mystic Arts Masonic Lodge. He loved music and art; he supported the Buffalo Philharmonic and was a life member of Albright-Knox Art Gallery. He also collected Russian and Greek icons and American paintings. In addition to Bernice, he is survived by a daughter and a son.

After graduating from MIT, **Tony Savina** began his professional career at E.L. Patch Pharmaceutical Manufacturers, where he worked for 13 years. He then moved to the Stamford, Conn., laboratories of American Cyanamide, where he worked for the next 30 years until his retirement. Tony was active in a large number of community organizations. First of all, he was long active in the MIT Club of Fairfield County, serving as its president and for many years as a director. Other organizations in which he was active include the Institute for Retired People, the Forum for World Affairs, the Stamford Historical Society, AARP Chapter 546, the Senior Men's Association of Stamford and Darien, and Friends of the Ferguson Library. He was also a member of Friendship House, Interfaith Council of Stamford, and Council of Churches and Synagogues. His other affiliations included the Connecticut Coalition on Aging and the Belltown and Dolan School PTAs, where he was a past president. He is survived by his wife, Julia, and two daughters.

Ted Riehl worked for Goodyear Tire and Rubber Co. in Akron, Ohio, from 1931 until his retirement in 1971. He began with an eight-year assignment in the research department during the course of which he was involved in the development of the first rayon cord tires, which Goodyear introduced in 1938. During World War II he was involved in the development of synthetic rubber tires. In 1955 he was named manager of product development compounding and in 1964 he became chief chemist, a post that he held at the time of his retirement. After his retirement Ted and Margaret moved to Tucson, Ariz., where they were living at the time of his death. During his retirement years Ted became interested in the Arizona-Sonora Desert Museum, an outdoor museum emphasizing the ways in which flora and fauna adapt to very dry climates. Ted was an active member of the museum's board of directors for many years and was also active in the Arizona Nature Conservancy. In addition to Margaret he is survived by two sons, and four grandchildren.—**Gordon K. Lister**, secretary, Apt. 40-D, 5707 Williamsburg Landing Dr., Williamsburg, VA 23185

31

65th Reunion

Please send news for this column to: **Wyman P. Boynton**, secretary, 668 Middle St., Portsmouth, NH 03801; tel: (603) 436-1309

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What will I write for this issue of *Tech Review*? I don't even have an obituary. I don't want to miss an issue. Alright, I'll write about myself this time.

Please, classmates, pick up a pen and write something. I don't want to wait for your obituary. Write about your life—old inter-

ests, new interests, high points, low points, medical points, elderly wisdom—anything! Just write. I'll edit and the *TechReview* staff will edit me.

John Brown nominated me to receive a Harold E. Lobdell '17 Distinguished Service Award for "services to MIT through the past 63 years." And sure enough at the Leadership Alumni/ae luncheon I was presented with a plaque and a clock properly inscribed. Five of my family were invited guests.

Most of the conference was devoted to how MIT can develop leaders. Then a questionnaire was sent to me and I was encouraged to share my thoughts on this interesting subject.

I answered in part as follows:

FIRST—Who am I? I was an average MIT student with an average personality. In a very modest way I've had some leadership roles over the years:

- President of Lloyd Laboratories for over 40 years.
- President of Temple Shalom for 3 years.
- President of Essex Community Concert Association for 3 years.
- Chairman of the Salem Combined Jewish Charities for a few years.
- Class officer of 1932 for many years.
- Plus other minor positions in several other organizations.

SECOND—How did I attain these "leadership roles?"

- By being helpful where I could.
- By always trying to have a specific plan to meet the problem at hand (This possibly is my most important point). Very often others floundered.
- By trying to improve my communication skills—written and verbal. By engaging in one-

to-one discussions. By public speaking whenever the occasion arose.

•By always trying to develop cooperation and goodwill with my fellow workers.

THIRD—How helpful was MIT in developing leadership skills for me? The education was solid but otherwise not very helpful. (This was from 1929 to 1932.)

FOURTH—What can I suggest that might develop leadership skills?

•Maybe a short course in which a dozen leaders' lives are studied and try to understand what made them "tick."

•Perhaps a dozen imaginary situations be drawn up. Then allow students to publicly debate what they would propose.

The subject is intriguing and I'm sure it is more complicated than I make it appear.

Perhaps it is in the genes and cannot be taught—only encouraged.

Classmates, your comments on this subject would be welcomed.

In August I participated in the National Lawn Tennis Tournament (for 85 and over) held at the Longwood Lawn Tennis Club. I won the first round but lost in the second to a Californian. I hope to try again next year.

Let me hear from you—no matter what!—
Melvin Castleman, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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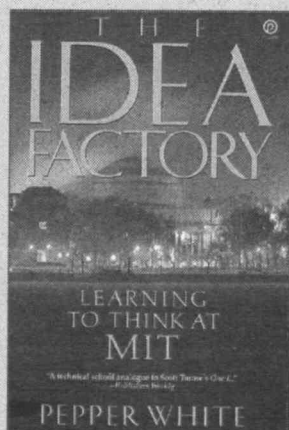
I recently had a confirmation of the fact that this column is seen by readers outside our class. Mrs. Louise Swanton (wife of John R. Swanton, Jr., '31) saw an item about one of

ClassNotes

our classmates in the October '95 notes that she knew would be of particular interest to the late gentleman's daughter. Mrs. Swanton enclosed the entire column from the *Review*, along with a personal note addressed to "Gretchen, daughter of Robert M. Kimball," and sent it to me at my address, with the obvious hope that I would be able to forward the message to its intended recipient. The column was "a good record of your dad's time at MIT," Mrs. Swanton wrote to Gretchen. I am trying to track down an address for Gretchen, whose wedding photo, with her new husband, was submitted for our 25th Reunion Classbook by her proud father. . . . **George Ropes** writes that he missed our 62nd Reunion because he and his son, George Jr. (Course XVII, SM '78), were visiting the great museums of St. Petersburg and Moscow. George Sr. concurs with other recent travelers to Russia, who now say that Russia is becoming more like the rest of Europe. Most rules and regulations are gone, and the situation is much improved as regards interference with travelers, poor food, and long delays. Both George and his son were struck by the great number of French impressionist paintings in Russian hands. They did not say "wish you were here," but I wish I were.

Edward Atkinson wrote to say that he would have enjoyed going along with Meyer Shnitler, Meyer's friend, Selma Goldberg, and

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myself, when we returned to the streets and neighborhoods of Boston where we grew up. We undertook this trip shortly after the 62nd Reunion, and Dr. Ed writes that he and his older brother made the same trip two years earlier—visiting the Codman Square area where he was born. In further remarks on the October '95 column, Ed wondered if my criticism of the lack of ornamental plantings around Kresge brought any response, and he went on to relate an incident in the life of **Winthrop Field Conant**. (At the time of writing the October column, where I first mentioned Win Conant's death on April 5, 1995, I had no other details.) Win and Ed came to MIT with the Class of 1932 from Newburyport High School; they had financial help from the Wheelwright Fund, which supported MIT students from Newburyport. (Among the other students supported by the fund were at least one Nobel Prize winner, Robert S. Mulliken, '17, as well as **Winthrop W. Adams** and **Leburton D. Webster**.) Ed says that Win Conant, much like the rest of them, commuted to MIT on the B&M Railroad. Although Win apparently did not receive his degree and couldn't afford to pay for a regular *Technique* photograph, his picture does appear on page 106 of the 1933 yearbook as a member of the track team. Ed fondly recalls meeting Win on the track team in their sophomore year, and they met subsequently through their fellow natives of Newburyport. Ed will understand if I include the following story, one of the most endearing anecdotes that I have ever heard about any of our classmates. Win's true love was for cross-country running, but one spring, he agreed to run in the two-mile events. He usually finished last, but on one occasion, his determination and unflappability drew loud cheers from the crowd: He was coming in a full quarter mile behind the winner and encountered the 220-yard hurdles that had already been set up for the next event on the track backstretch. Calmly and assuredly, he jumped over them all. Whattaguy, what guts!

It is always saddening to report the passing of classmates, but particularly so when their deaths are not reported to me or to the Alumni Association in a timely way, or when we have little information to report. Such was the case recently with two members of our class: **George Adolph Stoll** passed on October 18, 1986. He was a Course IX-B graduate who prepped at Chauncy Hall School, and who commuted to MIT from Jamaica Plain. He married early in 1935 to Jane Sutherland, and they raised a son and daughter. There are three pictures of George in our 25th Reunion Classbook: two of himself (one in his "dinky" ROTC uniform) and one with his son. He was the president of M. Stoll Co., a Pembroke, Mass., wholesale grocer and food purveyor to large institutions, and at one time was elected president of the New England Wholesale Food Distributors' Association. During WWII, George was co-chairman of Ship Suppliers Division, War Shipping Administration, Port of Boston. His hobbies included freshwater fishing, and he was handy with woodworking and machine tools. On retiring, he became a volunteer firefighter in East Pembroke. . . . **Raymond W. Smith** (Course II, SB) passed on December 1, 1992. He entered MIT from Edward Searles High School in Methuen, Mass. Our 1933 *Technique* says that Raymond was with the MIT Ordnance Association,

ROTC, which apparently was instrumental in his becoming the ordnance officer for the 17th and 82nd Divisions of the Army during WWII. He retired from the Army with the rank of colonel with distinction, and with the Legion of Merit and Bronze Star. He started working with the Blue Ridge Class Corp., ultimately becoming VP and general manager. He married Olive A. Dunbar in 1937, and they had one daughter. Raymond was involved in community development with the Kingsport, Tenn., Chamber of Commerce and Rotary Club, with time off for philatelic interests and fishing.

Although the death of **Robert J. Stoddard** was listed in the Reunion Memorial Service brochure of June 1995 as having passed on during the preceding year, the verified date of his passing December 4, 1990. Robert was a Course I SM graduate who entered MIT after earning a bachelor's degree in civil engineering at the University of South Carolina. His MIT thesis on the effects of wind pressure on the structural bents of high-rise buildings was undertaken with **William Niessen**, SB and SM '33, also Course I. After graduation, these two were reunited at the American Hoist & Derrick Corp: Niessen as chief structural engineer and Stoddard as executive VP. Stoddard held mechanical and design patents in crane design that led to his service in WWII with the Technical Intelligence in Europe. He married Harriet S. Baker in 1931, and they had two daughters. After he retired, Stoddard continued on the board of directors of Plastics, Inc., and also with many St. Paul, Minn., civic interests, including the Chamber of Commerce, school and hospital boards, and service as warden of the Episcopal Church.

Ralph Kirk James passed on March 31, 1994. His passing was noted in the *New York Times*, and even more completely at the U.S. Naval Academy's funeral liturgy, held in the academy chapel. Ralph was born in Chicago in 1906, and he attended the Armour Institute of Technology before his appointment to the Naval Academy in 1924. As a midshipman, he served on the battleships USS *New York* and *Utah*. In 1930 he went on to the Naval Post Graduate School, was then transferred to the Navy Construction Corps., and earned the SM in Course XIII-A in 1933, along with many other academy graduates. He had a long and distinguished career as a naval officer and received many honors for his service, including the Secretary of the Navy's Commendation Ribbon in 1942, the Bronze Star in 1943, the Legion of Merit in 1944, and honors from the monarchs of the Netherlands and Sweden. When he retired from the service in 1963, having served as chief of the Bureau of Ships with the rank of rear admiral, Ralph received the Distinguished Service Medal, presented by the president. Admiral James' pride knew no bounds when he was aboard the nuclear-powered aircraft carrier *Enterprise* in 1961, when it outraced one of the fastest greyhound destroyers of the Navy during sea trials in the Atlantic. He was heard to exultantly exclaim, "We



Ralph James

whipped this tremendous hull around somewhat like a speedboat." From 1963 until 1969, Ralph served as executive director of the Committee of the American Steamship Lines, an association of 13 shipping-line presidents. He was married to the former Virginia Cooper for 65 years, and is survived by his wife, a son, a daughter, four grandchildren, and an abundance of great-grandchildren. An early photo of Rear Admiral James is in our 25th Reunion Classbook. —Berj Tashjian, secretary, 1245 Briarwood Ln., Northbrook, IL 60062-4556; tel: (708) 272-8683

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Today's mail brings us bad news from Mel Sousa telling of the death of his beloved wife, Winnie. His letter follows: "Winnie passed away on August 24, 1995, of instantaneous cardiac arrest. There was no warning, as allowing for her age, her health was stable. She enjoyed the '89 Reunion and would have attended the 94th had it been in another Chatham Inn. Winnie worked for North American Aviation (NAA) for 30 years during and after WWII. Her official responsibility was the creation of the illustrations for the repair and maintenance manuals. She had other unofficial duties. The foreign field representatives sent photographs to her from various theaters of operation during the war. After the Rockwell merger and her retirement, the corporate office discovered what she had done



WINNIE SOUSA,
WIFE OF MEL
SOUSA, '34

and asked for copies for their records. In the other duty, she served as the NAA publicity or pinup girl. I have enclosed one of many photographs of her posing on the wing of a new airplane model or series. Her ashes were spread at sea off Playa del Ray, as she always desired. I have found that I am not the stoic I thought I was. Life is now not only lonely, it's empty." Mel's address is: 21895 Ave. 245, Lindsay, CA 93247-9795. He would appreciate hearing from his many friends.

A letter addressed to our former deceased secretary, **Bob Franklin**, has just reached me. It is from the son of **Edward Sieminski**, Richard, advising us of the death of his father on May 5, 1993, in Fullerton, Calif. Your secretary remembers Ed from Freshman and Sophomore Football where he was a star halfback. Ed, known as "Siemi" to his friends, and his wife Felicia, who survives him, were both born in New Bedford, but moved to New York in the '40s. Ed was Course VI, and after graduation worked for Sylvania Electric, American Machinery & Foundry, and finally Grumman Corp. until his retirement. He was an active alumnus, and he and Felicia were regular attendants at class reunions. Ed and Felicia were both accomplished ice-dance skaters, competing in many meets across the Northeast. Ed was also a well-known figure-skating judge. In addition to his wife Felicia, he is survived by his son, Richard, and four grandchildren.

We learn of the death of **Chesley Ayers** from the secretary of the Fairlane Chapter of the Michigan Society of Professional Engineers. Chesley had been corresponding with Bob Blake of the Alumni/ae Office, planning a joint

meeting of the MIT Club of Southeast Michigan and the Michigan Society of Professional Engineers. Chesley was a professional engineer with the U.S. Department of Defense in Detroit, Mich. He is survived by a nephew, **Richard Fellrath**, also of Detroit. We have no other details other than the date of death on May 22, 1995. . . . From Houston, Tex., **Marie Hale** sends word of the death of her husband, **Allyn W. Hale**, on December 12, 1994. Allyn was owner and operator of the **Allyn Hale Co., Realtors**. We have no other information.

A letter from **George Patch**, who played hockey with our president, **John Hrones**, tells us that his health is good, although his wife has been having some health problems. He has been blessed with two children, six grandchildren, and seven great-grandchildren. He keeps busy by volunteering at two local (Boothbay, Maine) historical societies. His recent travels have taken him to James Bay, Ontario, Labrador West, and to various places in New England, coastal Georgia, and Florida. He reads regularly and enjoys historical novels and mysteries but has no favorite author. He rarely exercises, does little corresponding with classmates, and never sees any. . . . **Roger Williams** fell recently and broke his hip. The hip was pinned and Roger has been getting around with a wheelchair or walker. He has spent some time at the Braintree Rehab Center. A further complication is that Roger has been troubled with a bad knee on the same leg. We all wish him a speedy recover.

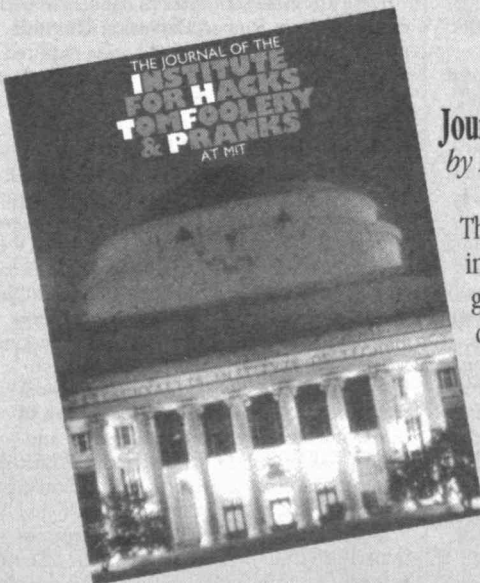
Your secretary recently visited Naples, Fla., for the 25th Anniversary of the Sun Glass

ClassNotes

Association of America. A charter member, I was presented with a plaque recognizing my contributions to the association in writing manuals for good manufacturing practices for manufacturers, assemblers, and importers, as required by the Federal Drug Administration, as well as the development for quality standards for ANSI and the International Standards Organization (ISO). A humorous (now) anecdote concerning the ISO follows. After a meeting in Berlin, to work on these standards, I left my hotel near the Berlin Woods for an early morning run. In the course of the run, I became lost and almost three hours elapsed. It was too cold to stop and walk, and panic started to set in. Finally I found a road that came out at the Berlin Wall. That served as a reference point and suggested the route back to the hotel. Meanwhile, a frantic wife had appealed to the hotel management and fellow delegates from the SAA to organize a search. Police were dispatched, but I finally arrived under my own power and sense (?) of direction. In recognition of that morning, Mollie was presented a crystal sphere with a piece of the Berlin Wall imbedded. While in Florida, we visited Mollie's five great-great-nieces and nephews.

Planning is under way for another meeting in late October of the reunion committee. Early calls reveal that **Roger Coffey** will be away

Hack \hak\ *n* 1: A prank, usually elaborate. *v* 1: To perform a prank. 2: To explore the places on campus that are not usually accessible. 3: To work at or study a subject not especially for academic gain.



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in Washington visiting his daughter. We mentioned Roger Williams problem above. Al D'Arcey reports that he is now a diabetic and is still struggling to get accustomed to new diets and regular meal times. He feels great, and is still playing golf, but was reluctant to depart from his regular regime. We expect that the group will be augmented by a delegation from the Cape, namely: Bill Ball, Earl Lockhart and wife Helen, and Felix Conti and his wife. While Felix actually lives in Lexington, he and his wife are still at the Cape. More on the meeting in our next notes. In our last column, we forgot to wish everyone a healthy, happy New Year. Please accept our belated, but nevertheless heartfelt wishes. When you read this, your secretary will be back in Colorado. Anyone getting to the San Diego area before March 31 should call us at (619) 435-3712. The welcome mat is always out!—Carl H. Wilson, secretary, 1820 Avenida del Mundo, #309, Coronado, CA 92118-3014

35

Lester A. Brooks wrote recently to tell me how much he had enjoyed reading the summary I wrote of our reunion. He said he had been guest columnist for his local

paper and remembered the amount of time it took putting everything together so that it made easy reading. He also pointed out that his Course X puts out an annual alumni/ae bulletin with a few articles and a list of those grads who had contributed. Les said, "I saw names I'd almost completely forgotten about. I don't ever recall seeing their names listed in your Class Notes. I've concluded that an awful lot of '35 grads have never written to you. Am I right?" The answer to that is there are more than 50 percent of our presently listed class members who have never taken time to write in the last 60 years.

I challenge some '35ers in the Chi Phi fraternity and still more in my Course VI and others who rowed in the crews to take time to write something before my deadline (in early March 1996) for the July 1996 issue of the *Review*. I promise to list up to 10 of our silent members still living. Those notes will be published in the Nov/Dec 1996 *Review*. So let's get started!

This next bit from Les Brooks may awaken some things you can tell us about. On his way home from the reunion, he drove through Allston to take a picture of his old homestead, wondering if anyone had found an old spark coil that he had squirreled away up in the attic crawl space. He and a friend up the street thought it was a lot more fun communicating with one another via morse code rather than the telephone. "But boy did we ruin the local radio reception when we were talking!" On another matter Les said he used to get an Alumni/ae Fund request about every November, and he always sent in something and later got a thank-you from Hal Bemis. "But such solicitation letters stopped several years ago, so I've made no contribution of late. *Who's Been Goofing?*"

We celebrate the life of Christopher Alois Rafferty who died on May 4, 1994. He was semi-retired and associated with Car Associates in Saugerties, N.Y. If you knew him as an undergraduate, please send me any news that you can. Your secretary is suffering with carpal tunnel syndrome and will have more

news after a doctor's appointment. See next *Review*.—Allan Q. Mowatt, secretary, 715 N. Broadway #256, Escondido, CA 92025; tel: (619) 432-6446

36 60th Reunion

A message from class president Alice Kimball: "The reunion schedule, starting on

June 4, includes a 48-hour opening at the Hilton in Dedham, to give us time to catch up with one another's activities, then on to Cambridge and Pops June 6. A luncheon is planned for Friday at the Museum of Science in Boston, at which widows of classmates will be our guests. Technology Day and lunch are Saturday, June 8. Hopefully, classmates who cannot participate in the entire program will arrange to attend one of these group meals." The Dedham Hilton, adjacent to a large wooded area, is suited to those who like to saunter on a path around the hotel complex, or use the indoor pool and other facilities, or enjoy watching others at it.

Correspondence from Alice's reunion advisory panel includes notes from Hulda and Phil Gilinson: "We will be on a world cruise from January 4 to April 16, so unable to help with plans then." . . . From Slim Beckwith: "I'm getting in shape for rowing on the Charles again." . . . From Ken Arnold: "I have been recovering from a quadruple by-pass operation on July 5, but all restrictions on my activities were removed in August." . . . Peg and Fletch Thornton have moved to Crawford Village, in Exeter, N.H. . . . Jan and Bob Gillette now live in Shelburne, Vt. . . . Stan Johnson mentions, "Astrid still sings with the Sweet Adelines and does radio station reading of news and local activities to blind adults. I swim at the 'Y' several times a week, am active in the Men's Garden Club, and raise all kinds of vegetables in 400 square feet of our backyard." . . . Harry Essley, our reunion gift chairman, is well equipped for the job, because he learned at an MIT meeting in Rochester that he, like many others, could have his cake and eat it too. By changing from a bequest in his will to a pooled income fund in 1994, he and Elizabeth increased personal income over their lifetimes, yet saved capital gains taxes. Perhaps you saw their picture on the Donor Profile page of January 1995 MIT section.

A letter from Bob Newman tells of traveling since 1976 mostly by automobile in Central and South America, Europe, the British Isles, Scandinavia, Upper Africa, the Trans-Siberian Railroad—and making some 20 video tapes, two of which will be available at the reunion. Any future travelers to these areas? Bob offers to send the list of tapes, and duplicates of any tapes desired—free: contact him at 381 Eden Rd., Springdale CT 06907, (203) 322-2905. . . . Also for viewing at the reunion will be the Robert Burns Woodward episode of the PBS series "The Nobel Legacy." Midway through the Harvard-made hour, his MIT beginnings are mentioned briefly (less than has appeared in these Notes).

From Boris Maximoff: "I climb an 1800-foot mountain ridge about every other day and swim in my pool. Eyesight is dimming, but passed for driving last week. I traveled

recently to Australia, Norway, and back to native Russia. My home can accommodate any classmate who happens to be in the area of Lost Altos, Calif." . . . David MacAdam retired from Eastman Kodak as senior research associate in 1968. In his career he was president of the Optics Society of America and editor of the Springer series on optical sciences. He won five medals and is a life member of the U.S. Committee of the International Commission on Illumination. He kept active as part-time professor of optics at University of Rochester, and is now emeritus. . . . Hans Lang's wide-ranging career included Standard Oil N.J., Lummas Co., president of Pritchard Corp., Procon, Inc., and Engineering Group International Systems and Controls, and he passed the California bar exam, prepared only by home study. At MIT, he instructed in thermodynamics, and later lectured on management at Fairleigh Dickinson and New York University. Since 1985 he has been a professor at Stevens. He wrote several technical books and articles, and appears in *Who's Who in America*. . . . Dominic Meo, Jr., retired in 1971 as executive VP of Salem Oil and Grease Co. "The colloid chemistry courses were invaluable to me in treating garment leathers." He oversaw expansion of the company worldwide and acquired three foreign languages. He helped establish the leather technology program at Lowell Tech, and was honored by the American Leather Chemists Association for great service to the industry. Lou Stahl was a close friend. . . . Walter Frank Lenoir, Jr., is an active correspondent of Bill Rousseau's Chem Engineering Practice School group. Initially in engineering and research at Humble Oil in Houston, Frank moved to the family business and worked up to the presidency. Moncrief-Lenoir Manufacturing Co. produces corrugated and other steel products. When I telephoned with a question, his wife, Lucy told me that he had been hospitalized a week earlier with surgery on a broken hip, after a fall while working in their yard, but that he was doing well.

Here are some footnotes to tributes in earlier issues. From Roman Ortynsky: "In freshman year, Henry Mabie and I were required to attend the Infirmary's nutrient course, in lieu of 'P.T.', McCarthy's gym or any organized sport alternative, because we were underweight." Henry lived to be 83, and Ro will attain that age in March. . . . From Henry Johnson's widow Mary Ellen: "We had big plans—many things we wanted to do, but we were married only five months. Although we knew one another 36 years, I still had lots to learn from him." . . . From Bob Caldwell: "In 1935, as VI-A lab partners, Henry Johnson and I had an assignment to set up a power network using plug-in cables on a big switchboard. After completing the sequence—correctly, we thought—I pushed the button to throw the breakers and boom! sparks and smoke—all of Building 10 went dark! Neither Henry nor I became prominent electrical engineers, and found our calling in other fields."

Cheers for the lives of assistant secretary James F. "Pat" Patterson, Luis Emilio, George Schmalz, and Philip Slater. Pat died suddenly of a heart attack October 12 while mowing his lawn. Ever active—hunting, swimming, gardening, singing, civic affairs, and never a serious illness nor a tremor. His ready assistance and clear, complete reports (see his 50th biog-

It's been some 60 years since the Pan Am *China Clipper* made its first flight across the Pacific, but the memory of preparations for that historic occasion is still vivid for John G. Borger, '34.

In 1935, Borger was a junior assistant engineer on an eight-man team at Pan American Airways that had only two months in which to outfit the S.S. *North Haven* with personnel (80 construction workers, 26 staffers for Pan Am's Pacific installations, 10 supervisors and observers, plus the ship's crew) and all the supplies they would need to set up island stations along the route to Asia. The stations would provide navigational support and refueling points for the flying boats—airplanes designed to land on water—plying the Asia route. Pan Am's million-dollar-plus capital appropriation for the project (in 1935 dollars!) covered everything from the state-of-the-art direction-finding stations for all the bases, including Honolulu, Guam, and Manila, to semi-prefabricated buildings and a six-month supply of food for the more remote installations on Midway and Wake.

Pan American Airways is no more, and in any event, Borger retired back in 1980 as the vice-president for engineering. But the Pan Am Historical Foundation and its publication, *Clipper*, is still alive and well. In its spring 1995 issue, it published Borger's recollections of the mission, from which this article is taken.

He recounted preparations conducted with stunning attention to detail, but there was still plenty of demand for ingenuity once they arrived in the Pacific. "I was told to acquire 35-foot [antenna] masts for all the stations," Borger wrote, "and I did. They didn't tell me they meant 35-feet above the ground, plus another 5 feet in the ground. We got the 40-foot masts in Honolulu, and my 35-foot masts later became stringers to reinforce the docks on Midway and Wake."

The Pan Am Clipper's First Flight to Asia

The ship carried (for each base) diesel generators to supply electricity, windmills to pump water, 4,000-gallon tanks for storing water and aircraft fuel, and Caterpillar tractors with interchangeable bulldozer blades and cranes. There was even some light-gauge railroad track that proved useful for more than one unexpected application.

Sometimes they were able to rely on well-developed port facilities. Other times they had to unload onto barges in the open sea, use launches to tow the barges through the reefs to the beach, then transfer the cargo to custom-designed sleds which could be towed to appropriate sites by the tractors.

"We had to clear a six-foot deep area through the coral heads in the Wake lagoon for the flying boats to land," John wrote in one particularly colorful passage. "So we hung a length of a light-gauge railroad track six feet deep under a barge, and a launch towed the barge back and forth across the lagoon. When the track hit coral, it shook the barge, awakened the guy sleeping on it, and he threw a cork buoy with an anchor to mark the spot.

"Then Bill Mull-ahy (another youthful team member who had recently graduated from Columbia) and I, in a rowboat, rowed out to the buoys. Bill put on goggles he'd made out

of bamboo, took a spear, and dove down to inspect the coral head. The spear was in case he saw any fish that looked good for dinner while he was inspecting. Scuba gear had not been invented; he just held his breath. Bill surfaced and asked for six or eight sticks of dynamite, dove back down and tied them to the coral. He resurfaced. I rowed upwind as far as we could go, and he pressed a magnet button and blew up the coral. We rowed back, picked up the tastiest-looking fish killed by the blast, and brought them back for dinner. We did this until we cleared a pie-shaped landing area with the point near the dock that we marked with empty 50-gallon diesel drums. We'd built a 400-foot dock (using the afore-mentioned 35-foot antenna masts) and attached



the barge to the end of it. The barge then had a more dignified name: it became the landing float."

The *North Haven* had set out from San Francisco on March 27, 1935, and in November, Borger recorded, the first Pan Am *China Clipper* landed at Wake on its way to Manila. "Air service to Asia had begun." □

—SUSAN LEWIS



John Borger, '34, was part of the team that prepared refueling and navigation bases for the first plane to cross the Pacific, the Pan Am *China Clipper*, shown at left ready to take off from a dock at Newark Airport and having landed at Pearl Harbor in Hawaii.

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raphy) on mini-reunions and other class items were a joy to include in this column, and his concern for wife Marian and their daughters was always apparent. Officers of the class and many friends will miss his warm enthusiasm and good will. . . . Unknown to Pat, his friend and classmate, Luis Emilio, had died September 5. An October letter from Luis's brother Philip told of their long ago acquaintance with Connie Bouchard and his classic cars. Luis left engineering (United Shoe, Ryan Aeronautical) in 1963 to devote full time to farming, including chickens and walnuts, with much success in California. Yet his interest in the Institute never flagged, and he frequently sent clippings or told his brother of interesting articles in *Technology Review*. After a year of inability to stand or read, Luis took himself off dialysis. . . . George Schmalz died August 23 at the Life Care Center in Auburn, Mass. He retired in 1975 from engineering and personnel management at Dennison Manufacturing, and devoted more time with wife Barbara to volunteer work at Hahnemann Medical Center in Worcester. My meeting his daughter and nieces and their husbands in 1992, as they helped to keep their widower dad/uncle's home in shape, is a fond memory. At that time, he was very active in a large bridge club. . . . A *Newark Star Ledger* item tells of Philip Slater's death July 26. At my visit to Spring Lake in 1989, he spoke of his daughters' musical talents, and only his wife, Cecile, mentioned Princeton. But the obituary speaks of study under Albert Einstein at the Institute of Advanced Studies, and of his playing the viola in Einstein's string quartet. After actuarial practice at Equitable Life and serving as an executive of Federation Pension Bureau, he headed his own firm of Woodward and Slater. Eli Grossman knew him at Tech and was an influence on his decision to be an actuary.—Frank L. Phillips, secretary, 1105 Calle Catalina, Santa Fe, NM 87501; tel: (505) 988-2745

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From Stroudsburg, Pa., comes news from Bob Glancy covering a number of subjects: "I am completing a year as first VP of the Golden K. Kiwanis in Labar village. I met many

of the important people in Stroudsburg and am scheduled to be inducted as president. I teach a Sunday School class of senior ladies (the retired Army colonel who was a member won't come any more). I have learned the hard way how to handle a dead CMOS battery in my computer. You need a bootable disc and the CMOS data relating to any hard drives you have in order to get back in business. I have begun a program of walking a minimum of 5 miles every day and, as of this writing, have completed 65 consecutive days, but I am thinking of cutting down a bit on the 5 miles; it takes too much time."

A touching letter from Walt Blake tells of his 50th anniversary in 1994, which six of his children and grandchildren celebrated at the Cloister, Sea Island, Georgia. The joy was not long-lived, however, since his wife Susan passed away in the summer of 1995. Walt published a memorial piece, "Recognizing the Life of Susan Stoll Blake," to which many friends and relatives contributed remembrances. One of the most relevant was his own memory of his first sight of her. He was sta-

tioned at the Research Center of the Aberdeen Proving Ground in Maryland. His piece follows: ". . . the WAACS are here! We rushed out. I got an optimum spot on the curb. Skepticism was blotted by our pride as they approached—a long column of women marching in perfect precision. In the lead was the commanding officer, a striking woman. I teetered on the curb, smitten. That was the beginning. This I recall so vividly now after 50 years of marriage to her. I was lucky to have been on that curb." Your classmates grieve with you, Walt.

After a long silence, Sidney Mank unburdens himself in a long and personal letter. He has had to move from his small farm in Washington, Va., to Charlottesville, Va., to be near the University Hospital that handles his health problems. And he has them. He lost his left arm at the elbow, is on his second pacemaker, and has prostate cancer. Nevertheless, his letter is full of plans. "Travel is our main hobby and we do it at every opportunity. We are going to the reunion in Cleveland this year of the Sea-Bees, the civil engineer corps during WWII to which I belonged." In addition to his wife, Dot, whom he calls a "Trojan," his Virginia family includes his son, Andy, and wife Sally, both of whom have master's degrees in planning. "Dot and I are married 54 years and are more in love. We love plays and attend those sponsored by the University of Virginia. Dot started a health-equipment loan closet, which loans wheelchairs, crutches, etc., free to anyone who needs them. Harry Corman comes by once a year on his way to Florida, and Link Herzeca lives in Miami, so I see him occasionally." Sid also expresses his pleasure that Bob Thorson's health has improved, which Bob appreciates.

From a continuing care community in Myerstown, Pa., comes a newsy letter from Francis Houghton. Apologizing for his long silence, Fran reviews his life's highlights. "I retired in 1980 as chief chemist and pesticide surveillance scientist of the New Hampshire Water Supply and Pollution Control Commission and moved to Oak Bluffs on Martha's Vineyard, later moving to Vineyard Haven. Not being able to stay idle, I established two water-analysis and environmental labs, one for a private concern and later one for Duke's county. Nearly five years ago, we quit Massachusetts and moved to the community in Pennsylvania, where I am active in church work and some community activities. My brother is bringing me a sophisticated computer so I will have an indoor activity." Fran is generally in good health except for some osteoarthritis in his knees. He uses a cane and doesn't climb stairs.

We regret having to report the passing of Bill Burnet last February. He was the founder of Dynaquip Corp., a leading manufacturing of food-processing equipment. Bill developed several food-processing machines, including a fluidizer, which blends chemicals to form food products. He retired in 1975. We extend our sympathies to his family. . . . We learned of the death of Eugene Cooper by the return of our birthday greeting marked "Deceased 1992" from La Jolla, Calif. Our regrets to his family.

We would like to hear from you.—Co-secretaries: Leonard A. Seder, 1010 Waltham St., B345, Lexington, MA 02173; Robert H. Thorson, 66 Swan Rd., Winchester, MA 01890

Ed Hadley has arranged for our 1996 mini-reunion to be held Friday, June 7, at the Wyndham Garden Hotel, 477 Totten Pond Rd., Waltham, Mass., off Exit 27A of Route

128 between U.S. 20 and Route 2. Rooms will be available Thursday night after Pops and Saturday night after Technology Day, as well as Friday, commencement day. Ed will assist in arranging transportation from Logan Airport or the Institute. Accommodations and meals will cost about the same as last year. There is an indoor pool for those who do not want to join the afternoon discussions or who want to take a dip before or after. Ed says that this year we will have a private meeting and dining room large enough for all of us.

Norman Leventhal invited 19 classmates to a luncheon meeting in Norm's Beacon Companies office overlooking Boston Harbor. In addition to Norm and class president Fred Kolb, the meeting was attended by 60th Reunion co-chairs Norm Bedford and Sol Kaufman, 1996 mini-reunion chair Ed Hadley, and your class secretary Paul Des Jardins. The 60th Reunion committee reported that they revisited Newport, R.I., accompanied by Silvia Kaufman and Hilda Bedford, and they again surveyed the Newport Islander Doubletree Hotel, the Marriott Hotel, and the Newport Harbor Hotel and Marina. Accompanied by the hotel sales manager at each facility, they examined typical bedrooms, meeting rooms, public lounge areas, other amenities, and typical dinner menus. They kept in mind the mobility factor of the reunion group and the time element to explore the area and to visit the mansions and waterfront, which are unique to Newport. They all chose the Doubletree Hotel as their first choice, based on its amenities, up-to-date facilities, comfortable public areas, and swimming pool. The hotel has a very nice separate dining room for a group of our size, and the management has held two recent MIT reunion functions. A free van and a free water taxi make regular round trips from the hotel to the waterfront and shopping area, so we believe these will be more than adequate for transportation. The reunion committee suggested that we reserve 30 double rooms and a separate dining area for Tuesday, June 2, and Wednesday, June 3, 1998. We would return to MIT on Thursday, June 4, with transportation by a chartered bus. The group approved the committee report and requested them to make the necessary commitment for a block of rooms and to explore further which activities and group meals might be suitable.

The group then discussed the timing and location of the 1996 mini-reunion. A number of locations had been scouted by Ed Hadley in Danvers and Rockport, and one had been contacted by Sol Kaufman in Concord. These were contrasted with other locations more convenient to Cambridge, and Ed Hadley was commissioned to negotiate and make the final arrangements, which resulted in securing the Wyndham Garden Hotel.

The class steering group meeting ended in time for Fred Kolb and Paul Des Jardins to make the 3 p.m. Alumni/ae Leadership Conference session at MIT. Both of us attended meetings devoted to identifying the next generation of scientists and engineers, with examples from experience with the minority MIT

summer programs for high school students and the intern program for minority college students at Lincoln Labs. We also attended the session devoted to selecting MIT students for leadership, attended primarily by educational council members, discussing the qualities MIT seeks in its students. We spent the evening learning the degree to which the Alumni/ae Association is on the Internet, and discussing the kinds of information alumni/ae would like to see on the World Wide Web. Of MIT alumni/ae, 77 percent have personal computers and 31 percent have modems with e-mail addresses, so communication via the Internet is rapidly increasing in importance. Diana Strange of the Alumni/ae Association, who has been a major source of help to our class on our recent reunions, is spearheading the development of the Association's Internet activity.

The Saturday plenary session, awards luncheon, and afternoon panel discussion brought us up to date on where the leaders of MIT believe the Institute is pointed, curriculum changes being considered, and efforts being made to produce leaders. After the awards luncheon, the afternoon panel discussion presented six alumni/ae panelists who are leaders in their respective fields, talking about the impact of the MIT experience on leadership. Being at Tech for these two days left me with three impressions. (Be prepared for some of these sights if you return to campus when classes are in session.) First, the scruffy

Bill Hecht, '61, executive VP and CEO of the Association of Alumni and Alumnae of MIT, introduced Karen Arenson, '70, the new president of the Association, to northwest-

ern alumni/ae. Bill and Karen announced a new program at MIT to reduce nonacademic administrative costs by about \$40 million per year. It costs more than \$1.1 billion to operate MIT for one year. The full-time student body includes about 4,500 undergraduates and 5,000 graduates. In September 1995, 1,100 persons became the freshmen class at MIT; 42 percent were women. MIT is in the vanguard of U.S. universities and businesses and governing bodies that actively increase the proportion of women in leadership positions.

Pete Bernays, one of the first in our class to be honored with the Bronze Beaver Award, serves MIT as an educational counselor. Also, Pete just retired as lieutenant governor of about 40 Kiwanis Clubs in central Ohio. Still not fully occupied, Pete took up Frisbee-throwing. As Marie reached for one of Pete's high flyers, she broke a hip. The hip healed and therapy is under way. Pete and Marie visited professor emeritus Dick Hanau, who said his grandson joined MIT's freshman class in September. . . . Bob Withington retired in 1983 as VP, engineering of the Boeing Commercial Airplane Co. Encouraged in November 1992 by his wife, Betsy, he devoted about



Bob Withington, '39, wife Betsy, and their homemade amphibious monoplane.

appearance of today's students: For every neat, clean appearing student, there were nine who looked and dressed as if they are still in high school. Second, the number of bicycles and bicycle racks in use throughout the campus. Third, the availability and use of visual aids in lecture halls, and the ability with the latest slow-scan technology to have someone at Tech give a speech or lecture and have it transmitted over telephone lines to just about anywhere in the world with the clarity of black-and-white television and the ability to have a question and answer period. One day recently, President Vest addressed a meeting being held in New Zealand, and immediately following him an MIT professor gave a talk to a group in Tokyo.—Paul R. Des Jardins, secretary, 6251 Old Dominion Dr., Apt. 310, McLean, VA 22101-4807; tel: (703) 534-4813; Frederick J. Kolb, Jr., president, 211 Oakridge Dr., Rochester, NY 14617-2511; tel: (716) 342-3093

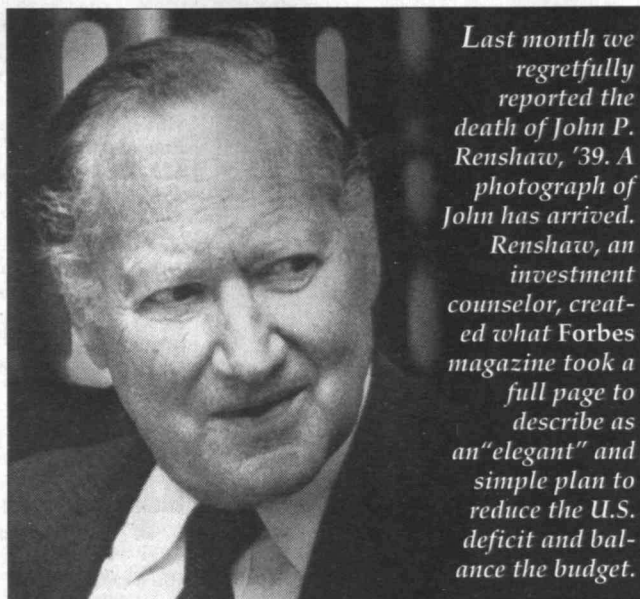
3,500 hours to building a two-seater monoplane at their home on Lake Washington. He made the wing and tail assembly and attached them to the prewelded fuselage he covered; he changed design from wheels and tail skid to floats. The plane is a Kitfox Model IV-1200, wingspan 32 feet, length 19 feet and 1 inch, height from aerocet amphibious floats to wingtop 7 feet, powerplant 80 horsepower, and propeller 72-inch 3-blade composite ground adjustable pitch.

In golf, Mike Herasimchuk shoots his age; in steelmaking with computer-driven quality control, he is still invited to address professional societies, including a chapter he founded 46 years ago in the Lehigh Valley. Mike and Jean celebrated the 45th anniversary of their wedding last year. . . . Harold Chestnut, author, expert in automated control and systems engineering, consultant within the General Electric Co., and recipient of many professional awards, set up the SWIIS Foundation in 1984.

It is privately funded and dedicated to improving international stability and world peace. Harold returned recently from Switzerland where others dedicated to SWIIS ideal met. . . . **Harold Muckley** likes fly-fishing, and he particularly enjoys it when Elizabeth and their daughter, both expert in fly-fishing, join him for a weekend of the sport.

George Beesley and **Eleanor** resettled in a pleasant Exeter, N.H., retirement condominium community, where George serves on the finance committee, helping to manage the 200-condo group. Eleanor continues her lifetime hobby: making jewelry. .

. . . **Bill Pulver** and **Adie**, having conquered many ski slopes in the United States, planned to join **Joe Dana** and **Jean** to ski in the Swiss Alps. However, during a routine physical update, Bill found a lump which caused him to cancel the ski junket and undergo chemotherapy. It would be timely for classmates to send greetings and encouragement to Adie and our class's former business manager of *Voodoo Magazine*. . . . **Al Graffeo** has strong religious convictions. For years, he helped many others with counsel and hands-on healings. His efforts on behalf of others are inspiring. . . . Class president **Manning Morrill** joined a group in Scotland to play seven golf courses in seven days during September. The final round was at St. Andrews, where golf started. . . . **Bob Touzalin** and **Aletta** motored 4000 miles to visit their children and their families. They golfed and tallied scores and "gimmies." In Amherst, N.H., they visited **Bob Schmucker** and **Jean**. In Arlington, Va., they enjoyed a pleasant afternoon with **Ernie Kaswell** and **Yolande**. Home again in Naples, Fla., the **Touzalins**

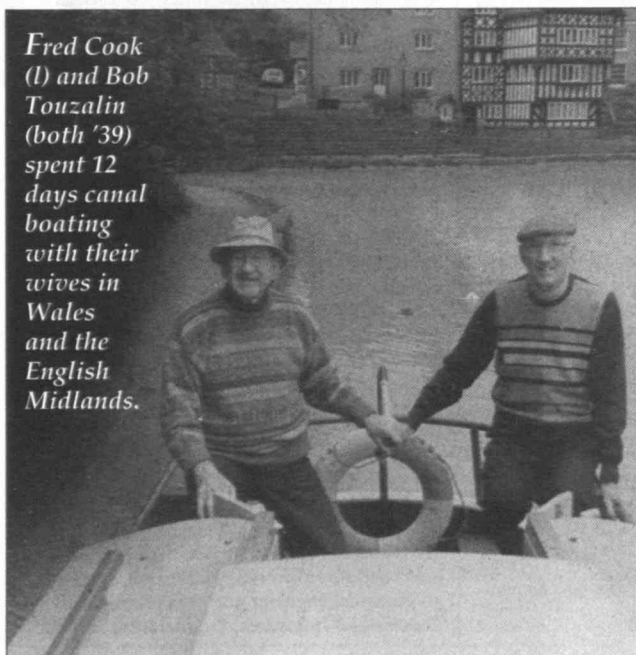


Last month we regretfully reported the death of John P. Renshaw, '39. A photograph of John has arrived. Renshaw, an investment counselor, created what Forbes magazine took a full page to describe as an "elegant" and simple plan to reduce the U.S. deficit and balance the budget.

wait for October's storms to end and their golf course to drain.

Fred Cooke and **Eugenia** joined **Bob Touzalin** and **Aletta** for 12 days of canal boating in Wales and the Midlands, England. Their unusual adventure included cruising on a canal elevated 70 feet above a river underneath. There is no record whether, one night at anchor, Fred took over the piano at a nearby pub for a patrons' sing-along, or whether Eugenia entertained with her unique version of the adventurous kitten. After 12 days of canalboating, Fred and Eugenia debarked to make preplanned visits with friends made during their career days in England. They visited Liverpool, rented a cottage at Tisbury, and saw Stonehenge again. In Exeter and Dorchester they researched genealogy on Fred's family, some of whom came to America in 1630 on the vessel *Mary and John*.

Barry Graham broke a foot during July and learned how to recuperate in a cast. By October, he was walking and driving, but says he is not ready yet to enter a squash tournament. . . . **Fred Grant** relayed a clipping from the *Boston Globe* stating that **Robert Fairbairn**, 78, died September 29, 1995. He worked in the MIT radiation laboratory in World War II. He held a number of patents in the textile industry and formed several companies, including **Fate Fairbairn, Inc.**, **Fate Engineering Management Corp.**, and **International Ion Systems**, all of Norwood. His most recent venture was **Sealure**, a lobster-bait company in Bourne. A former resident of Wellesley, he was a member of the board of directors of the Need-



Fred Cook (l) and Bob Touzalin (both '39) spent 12 days canal boating with their wives in Wales and the English Midlands.

ClassNotes

ham National Bank and the Carter Co. . . . **Charles Jephthiah Jeffus** died August 28, 1994. He was a resident of Greensboro, N.C. We have no further details. . . . **Stephen Aloysius Days** died June 18, 1995. He was proprietor of Mashnee Village, Inc., in Buzzards Bay, Mass.—**Hal Seykota**, secretary, 2853 Claremont Dr., Tacoma, WA 98407

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Sybil and I have been celebrating our 50th wedding anniversary. Our children and grandchildren had a long weekend of festivities for us in the Washington, D.C., area,

including an evening at the Kennedy Center, a visit to the Kreeger Museum, lots of poetry, pictures, memorabilia, and, of course, plenty of good food.

In August, The Alumni/ae Office received word of the death of **Fredyum Henrickson, Jr.**, of Syracuse, N.Y., on May 13, 1995. No further information is available. In addition, **Alaettin Mustafa Aksoy**, of Pittsburgh, Pa., passed away on December 16, 1994. He was born in Istanbul, Turkey, and received a doctorate at MIT. He taught for several years at Drexel Institute of Technology before joining Crucible Steel Co. as a metallurgical engineer. He retired from Crucible after 26 years. The class sends its condolences to both families.

That's all I have this month. Please reinvigorate the column with notes and telephone calls to **Richard E. Gladstone**, secretary, 250 Hammond Pond Pkwy., 1205 S, Chestnut Hill, MA 02167-1528; tel: (617) 969-5161.

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55th Reunion

Please send news for this column to: **Charles H. King, Jr.**, secretary, 7509 Sebago Rd.,

Bethesda, MD 20817-4839; e-mail: <olspaceman@aol.com>

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Bill Graham retired from **RAND Corp.** at Santa Monica, Calif., after 32 years service. For many years he was head of the Engineering and Applied Science Division. He's

now in Seattle and "fully occupied with house upkeep projects, errands, woodworking, ham radio, and travel." . . . **Alan Katzenstein** is a current member of the MIT Council for the Arts and continues as an active member of our local pinocle game, with classmate **Jim Stern**. . . . **James Girdwood**, a member of our class who graduated from the University of Maine in 1943, died in Denver. He served in the Marines in WWII and was discharged as a first lieutenant. He was president of Mountain and Plains Corp. in Denver.

Would like to have more news to fill in between the obits. Send some to me today!—**Ken Rosett**, secretary, Apt. 12, 2222 Americus Blvd. N., Clearwater, FL 34623

I am now receiving the benefit of the information super-highway without actually traveling it myself. The Alum-

ni/ae Association has started sending me printouts from various online news services with items about classmates. I think it means I'll be getting faster obituary notices.

Speaking of which, **Spencer H. Brewster** (Course XV) died August 13 in Plymouth, Mass. A native of Plymouth, Spencer attended Governor Dummer Academy and Williams College before coming to MIT. During WWII, he served as a captain in the Army Air Corps. For 25 years he was VP of the former Plymouth Cordage Co. and also founded the Agway store in Plymouth. During this time he served his community as a member of the Plymouth Town Meeting and the Plymouth School Committee. He had a wide range of interests, including the Helicopter Pioneers, the Pilgrim Society, the Elder Brewster Society, and a number of equestrian groups. Spencer is survived by his wife, Marietta, and by several generations of a large family. We extend to them our condolences.

I have received a few more details about **Richard L. Ackerman, Jr.**, whose death in 1994 was reported in the Class Notes of last April. Richard, along with his father and two uncles, was a loyal alumnus of Worcester Academy, which he attended before coming to MIT. At Worcester he was on the fencing and debate teams, was president of the photography club, and held membership in the astronomy, biology, and chess clubs. He continued his interest in fencing during his years at MIT. Richard reportedly lived a quiet life in Brookline, so it was a great surprise to all when Worcester Academy was left \$2.5 million in his will. It is one of the three largest in the academy's 161-year history.

The State Journal-Register, of Springfield, Ill., last fall published a lengthy article about **Corwin "Corky" Meyer** (Course XVI), who was inducted September 1 into the Carrier Test Pilots Hall of Honor in Charleston, S.C. As a small boy Corky saw Charles Lindbergh when he paraded through the streets of Springfield after his solo flight across the Atlantic Ocean. He built Springfield's first gasoline-powered model airplane from balsa wood, and learned to fly at age 17. Leaving MIT in 1942, he joined Grumman Aircraft Corp. as its youngest experimental test pilot. There he served as project test pilot for the line of Grumman fighters, starting with the Hellcat, and also flew the famed Japanese Zero. In 1954 he qualified in a jet for aircraft-carrier takeoffs and landings. During this time he survived 11 crashes, unhurt. Corky spent almost four decades with Grumman, and then continued in a variety of other high-level aeronautics jobs, including a term on NASA's Aeronautical Research and Development Committee. Today he lives in an Ocala, Fla., development which boasts its own 6,000-foot airstrip, and in which each home has an attached airplane hanger. In his spare time he



CORKY MEYER, '43

has taught his three grown children to fly, and has spent over 2,000 hours restoring a Grumman TBM-3 Avenger, a model that he tested in 1943. As yet there are no signs that he should be grounded for age or "disability." Keep 'em flying, Corky!

Jim McDonough sent me a program from September's Alumni/ae Leadership Conference. It lists his well-deserved Bronze Beaver Award and his membership on the Association's board of directors. Also listed is **Sid Atlas**, who won the Morgan Award for long and distinguished service with the Educational Council. Congratulations to both Jim and Sid.

The InfoSuper-H brought a good supply of news this time, but I still solicit and welcome individual letters.—**Bob Rorschach**, secretary, 4727 S. Lewis Pl., Tulsa, OK 74105-5138

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Our only news for this issue was from **Stanley I. Skelskie**, who sent in a remembrance of his MIT years and WWII service with the 345th Bomb Group of the 5th Air Force in the Western Pacific. We would have liked to publish his entire document, but it would have filled more than a page in the *Review*, and the editors were firm about that being too long. Stan was equally firm in his conviction that the edited version proposed by the editors did not adequately convey his experience. So the editors have proposed an unusual solution to the problem: classmates who would like to read Stanley Skelskie's record of his war and student years may request a copy from:

Audrey Saracco, Alumni/ae Association
MIT 10-140
77 Massachusetts Ave.
Cambridge, MA 02139-4307
tel: (617) 253-8490
e-mail: <saracco@mit.edu>

We hope that other classmates will not be discouraged from sending us stories of their war years, but will limit themselves to one or two incidents that stand out in their minds. Please send news for the column to co-secretaries: **Frank K. Chin**, 221 St. Paul Str., Brookline, MA 02146; **Louis R. Demarkles**, 77 Circuit Ave., Hyannis, MA 02601.

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Please send news for this column to:
Clinton H. Springer, secretary
P.O. Box 288
New Castle, NH 03854

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50th Reunion

Ted Heuchling continues to be a senior VP at the Arthur D. Little Co. in Cambridge. He is

also a trustee of the Arthur D. Little Foundation. Ted is chair of our 50th Reunion Gift Committee. Ted and Patsy have eight grandchildren. Recently Ted was the principal speaker at the annual dinner for MIT Friends of the Crew. This event coincides with the Head of the Charles rowing regatta. Ted is quite active in his Lexington, Mass., Catholic Church. . . . **Dave Hoag** and his wife, Grace, are living in Medway, Mass. They have five children and ten grandchildren. They own 20 acres of land that is mainly forest. Dave is in good health and is a member of the Medway Conservation Commission. He continues to be a consultant at the Draper Laboratory in Cambridge. . . . **Don Hurter** is semi-retired and is living in Norwood, Mass. For many years Don has been active as an entrepreneur. He helped establish an MIT program in this area. Don continues to be a consultant for the auto industry and is now restoring a 1928 Bentley.

Bill Semple spent over 20 years in the U.S. Navy and retired as a commander. Then he taught for many years at Thayer Academy in Braintree, Mass. Now he is on the faculty of the Harvard University Extension School, where he is teaching in a program, "Learning in Retirement." . . . **Clif Sibley** has retired after many years as a consulting engineer. He and his wife, Ann, have homes in Wellesley, Mass., and Hancock, N.H. Clif is in good health and is playing a lot of golf. . . . **John Maynard** and **Dan Cooper** look forward to further responses from classmates for our 50th Reunion yearbook. Send good quality pictures and general memorabilia to John at 178 Meadow Way, Palm Beach Gardens, FL 33418. Dan is at 15 South Orange Ave., South Orange, NJ 07079. Pictures from our 5th and 10th Reunions would be very appreciated. Any class members who have misplaced their biographical or questionnaire forms should contact Susan Tomases at the MIT Alumni/ae Association, Room 10-140, 77 Mass. Ave., Cambridge, MA 02139, or phone her at (617) 253-8216.

During the current MIT academic year, eight undergraduates are receiving substantial scholarship assistance made possible by gifts from members of the Class of 1946.

I regret to report that **Bob Striker** died of a heart attack on February 21, 1995. Bob was an electrical engineer and was president of Beaveronics Industries. He had lived in Port

Washington, N.Y. He is survived by his wife, Pat.—Ned Tebbetts, secretary, 9 Jerusalem Road Dr., Cohasset, MA 02025-1100; tel: (617) 383-1662

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Please send news for this column to: R.E. "Bob" McBride, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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Milton Slade received the 1995 IEEE AUTOTESTCON Frank McGuinnis Award. The McGuinnis professional achievement award is the highest honor, and it recognizes outstanding leadership, individual initiative and technical contributions to automatic test engineering. The award includes a crystal trophy kept for one year, a permanent plaque and \$1,000. Prior to his retirement from GTE Government Systems in 1991, Milton was active for 25 years of his 43-year engineering

career in the field of automatic testing in systems engineering and program management. While at GTE, he was responsible for programs involving tactical telephone communication and message switches and for the development of test program sets for field and factory support of printed circuit cards for these systems. Milt has been active in AUTOTESTCON since 1973. He was instrumental in revision of the charter and of the establishment of the position of agent of the board to maintain long-term memory and improve governance. He has been elected to several offices, and has been society VP and is in a second year as president. He pursued special graduate work at MIT while employed as a research engineer for the MIT Research Laboratory of Electronics and the MIT Flight Control Laboratory.

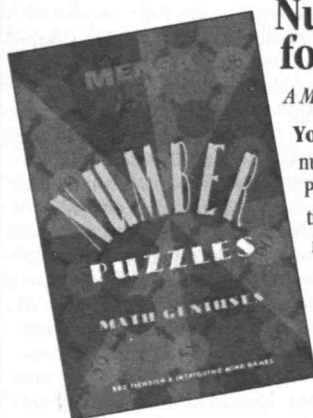
Denny McNear and his wife, Barbara, spent three weeks hiking in Switzerland. Barbara is the widow of Dave Gaillard, '49, who was Denny's roommate during college days. Dave's grandfather built the Panama Canal. Denny and Barbara met in 1947, and they are building a new house in Dennis on Cape Cod. They

ClassNotes

commute between Dennis and their home in Maryland.

Bernie Gordon made a keynote presentation at a recent IEEE instrumentation and measurement conference. The following summary of Bernie's activities is based on the conference notes. Bernie is chairman of the board and CEO of Analogic Corp., Peabody, Mass., an electronics firm developing advanced precision data conversion and computer-based signal processing and measuring instruments and equipment. The products are used in modern medical, industrial, communications, and other systems applications. Bernie is recognized as the "father" of high-speed analog-to-digital conversion techniques. He began his career helping to design UNIVAC, one of the world's first digital computers. At LFE he worked on the development of navigation radar and air traffic control systems.

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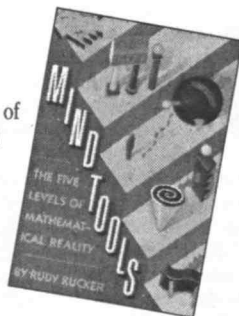
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In 1953, he cofounded EPSCO, Inc., and invented data acquisition and telemetry systems based on his work in A/D conversion and pulse code modulation. In 1963 he started Gordon Engineering and invented products including the first solid state X-ray generator, a digital pH meter, and a scanning electron microscope, all on a contract basis for other companies. He founded Analogic Corp. in 1969 and directed its major advances in data acquisition instrumentation, medical electronics, special purpose computation, and other areas. Bernie also led the team that developed an instant imaging CT scan system, which is the first step to create three dimensional images of parts of the human body. These systems include the ability to digitize the scanned data and then reconstruct artifact-free images. Analogic manufactures key electronic assemblies for more than 85 percent of the world's CT scanners. Bernie is a Fellow of IEEE and has received several awards. He holds more than 100 U.S. patents. He has endowed the Gordon Professorship of Engineering Innovation and Practice at MIT. The Gordon Institute that he founded in 1985 became part of The Gordon Institute of Tufts University in 1992.

Gloria Wong wrote to say that her husband, **Bachman Wong**, died in September from esophageal cancer diagnosed in mid March. They had just returned from a week of skiing at Taos in late February when one of the three tumors ulcerated making it difficult to swallow. Gloria said, "Bachman enjoyed being part of the telethons and the Technology Day festivities, lectures, and concerts." Until his death he was consultant for Standard Thomson in Waltham where he had worked before his retirement. Bachman and Gloria had been living in Wayland, Mass. On behalf of our classmates I extend our sympathy to Gloria and her family—**Marty Billett**, secretary, 16 Greenwood Ave., Barrington, RI 02806; tel: (401) 245-8963

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Your secretary was planning to have heart bypass surgery at the time Class Notes were due. We wish him well, and you can look forward to reading his April column.

By now, you should have received a questionnaire asking about your current activities for the *Review*. If you have not already responded, please send in your information soon.—**Ed. (Fletcher Eaton, secretary, 42 Perry Dr., Needham, MA 02192; tel: (617) 449-1614)**

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Your roving reporter begins with an offer related to our 45th Reunion last year. **Sam Raymond** arranged to have copies made and bound for the 200 bios that our classmates returned to the reunion committee. You can order a copy for \$19 (payable only by check) from: The Village Printer, Attn: Steve Chalmers, 121 Locust St., Falmouth, MA 02540. As an added bonus, your copy will also contain the script my wife and I used to present the class profile that was based on the over 170 confidential questionnaires that classmates returned. The \$19 includes shipping and handling.

Kathleen Black answered her phone in Bethesda, Md. She retired in 1992 after having spent 20 years with the Nuclear Regulatory Commission. Fuel facilities and fuel fabrication were her areas, but she also explored plutonium recycling. Kathleen does not expect this latter work to be implemented because of the dearth of new nuclear facilities and the supply of enriched uranium being more than adequate for existing plants. Kathleen says she is enjoying her retirement. She is spending time with her friends and some travel, the farthest so far being Texas.

Mel Gardner wrote me of sailing his boat last summer from Connecticut to Maine. There he visited Sylvia and **Fred English** in Harpswell. Fred retired in 1990 after 40 years with Lockheed in Southern California. His most exciting assignment there was managing the program for stealth aircraft. He spent the next few years selling the California house and negotiating the tenant out of his Harpswell house, which he and Sylvia had bought in 1985. Then he put a large room on the back of it, which has a magnificent view of the water. The original house, if you can imagine it, faced away from the water. Fred had designed and built his own California house. Among Fred's non-housing activities was a drive through northern Europe. There he visited **Jacob Aall** in Tvedestrand, Norway. Jacob manages the family estate there. When he took it over the business consisted of lumbering and tenant farmers, but was not doing well. Jacob negotiated away the farmers and built a golf course which, I am not making this up, he designed himself. Our class needs no Jack Nicklaus or Robert Trent Jones. The course is doing well and is scheduled to host a professional tournament.

Back to Mel's letter. Mel and Ellen stopped to see **Joe McCluskey** in Rockland, Maine, and stayed at the Lakeshore Inn, "a most attractive B&B" run by Joe and Paula Nicols. [Free plug: call (207) 594-4209 for bookings.] Joe retired in 1992 after 42 years with Commonwealth Edison in Chicago. He managed their environmental affairs. One challenge of his resulted from the manufactured gas operation that the natural gas pipelines put out of business. There was a residue at the bottom of the storage cylinders, which Joe told me was called "gorp." The gorp was bulldozed into the ground, and you can imagine the consequences. Joe next managed the uranium mining and milling operation in Colorado. Last April Joe and Paula went to Jerusalem to celebrate Latin Easter and then on to Tinos, Greece, to celebrate Orthodox Easter. In Jerusalem Joe found the Church of the Holy Sepulcher mobbed, as Hebrew, Islamic, and Christian religions were all celebrating a holiday. One final note from Mel: he and Ellen are again planning to winter in San Diego to avoid the Larchmont, N.Y., winter.

While in Las Vegas, I found two classmates in Sun City Summerlin, just outside of Vegas. **Bob Titus** retired four years ago as director of marketing for Cooper Industries. You all must know their Crouse & Hinds electrical products. Bob then moved from Orange County, Calif., to Sun City where the houses are nicely planned and there are many amenities aimed at our age group. Bob swims daily. He escapes the desert summer during June and July by house-sitting in Hawaii for his son who has a T-shirt business there. . . . Also in Sun City

Summerlin, I found **John Pampel**. John moved there three and a half years ago from Whittier, Calif., where he spent 35 years with Bechtel Power. John built power stations including one in Taiwan and his largest power unit, the Palo Verde nuclear plant. He likes cruising on the Holland America Line—Mediterranean, Alaska, etc.—and enjoyed a week in Majorca. John regrets the passing of his two roommates, **Don Young** and **Dave Uline**. John reports that Don's widow married Jack Eddy, from, so Alumni/ae Records tells me, the Class of 1949. . . . **Fred Werner** wrote me a note. (Class secretaries love to get notes from classmates.) Fred retired from Westinghouse R&D Center in 1988. A few years ago, "we gave up the joys (?) of owning a house and moved into the city of Pittsburgh to a condominium." Fred and his wife of 44 years (I would use her name, Fred, if you had written it) enjoy being close to music, theater, and universities as well as their volunteer activities of tutoring and Girl Scouts. They enjoy summers in the Adirondacks and foreign travel, usually once a year.—**Robert A. Snedeker**, secretary, Seven Mashie Way, North Reading, MA 01864; tel: (508) 664-1738

51 45th Reunion

Work is under way in developing the arrangements for our 45th Reunion. **Fred Ezekiel** and **Bill Cavanaugh** will jointly chair the committee. The overall schedule starts with our gathering at the Black Point Inn in Prout's Neck, Maine, on Tuesday, June 4. We will be there for two days, returning to Cambridge on Thursday for Tech Night at the Pops. The major banquet will be on Friday evening. Technology Day is on Saturday, June 8. As the details of this general plan unfold, I will convey them to you.

Having resigned from his position at Boston University as professor of international relations, director of the Center for the Study of Small States, and director of the Boston University Defense Technology Conversion Center, **Clark C. Abt** is continuing as the director of the Massachusetts Defense Technology Conversion Center. He has also closed Abt Books, Inc., a scholarly CD-ROM publishing organization that he had run for seven years. He is working on a book on the defense/development and economic growth trade-off.

We received word of the passing of **Peter J. Booras** in August. Peter ran a development consulting firm. He was active in politics and made a strong showing, finishing second in the 1972 Republican primary in a run for the United States Senate. He served as treasurer for the New Hampshire Republican Party. He was the coordinator of an attempt, with Aristotle Onassis, to build an oil refinery in Durham, N.H. He established the Yankee Energy Corp., a consulting and development firm specializing in the use of methanol as an energy source. We extend our condolences to his family.

Another sad note is of the passing in August of **James Ballou**. Jim was an award-winning architect. He was the project architect with Frederick Stahl and Associates working on the restoration of Faneuil Hall Marketplace in Boston. He received an Honor Award from the New England Chapter of AIA for his work

in the restoration of Front Street in Salem and the Bullfinch Award for his work on the USS Constitution Museum at the Charlestown Navy Yard in Boston, the Governor Shirley Eustis House in Roxbury, and the Salem Front Street effort. He designed more than a 100 residences in his career. We extend our condolences to his wife, Phyllis, and their four daughters.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

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The youngest of us are now approaching 65, and a spike in news of retirements can be expected. **Sandy Isaacs** writes that he retired last July from Children's Hospital; Nancy retired in October from her position as director of Lesley College's library. They have moved to their former summer place in Jaffrey, N.H., where they have 25 acres two miles south of Mt. Monadnock, and four spare bedrooms for their four children or wandering friends. Sandy has acquired a very fancy commercial-type stove, the better to practice his love of cooking, and he is still deciding what to do in retirement. Well, he could always open a country inn. . . . **Tony Ralston** retired last June from SUNY at Buffalo, where he was professor of computer science and mathematics. He is now living in London for eight to ten months of the year doing everything he ever did before, "except teaching undergraduates who don't want to learn." From his e-mail address, I guess that he is attached to Imperial College. He does not say what he does, or where he goes, the rest of the year. . . . Sandy's and Tony's messages were elicited by the start of the mit1952 listserv. As forward-thinking, up-to-date, progressive members of this class, they naturally are accustomed to using e-mail, and welcomed the creation of this service to help promote class activities. You too can show that you are forward-thinking, up-to-date, etc. by e-mailing a request to join the list to <mit1952@mitvma.mit.edu>, preferably including news of yourself to share with the rest of us.

Reunion chairman **Stan Sydney** writes that he has reason to expect that about 100 classmates or more will attend our 45th reunion at the Hotel Hershey, Hershey, Penn., on the weekend of October 21. He thinks that will make for a most successful event. Other classmates helping Stan with all the planning and work that go into bringing off a great reunion include **Lou DiBona**, **Herb Brody**, **Mel Cerier**, **Dick Heitman**, **Arnie Kramer**, class president **Bob Lurie**, **Bob Norton**, **Stan Solomon**, and **Art Turner**. If you have not already done so, make plans to come, too.—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301; e-mail: <rlacey52@aol.com>; listserv: <mit1952@mitvma.mit.edu>

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Fred Brecher and **Jeanette Sparks** were married at Carpenters Hall in Philadelphia on October 15, 1995. We are very happy for them and send them best wishes for a long, healthy, and happy life together! They both attended the MIT Alumni Leadership Conference in Cambridge in September. While

ClassNotes

there, they met **Gerald Dyar** who is a strategic planner in the Hartford, Conn., area. They also had dinner with **Berna** and **Bill Haberman**.

Frank Turcotte has retired from his job in construction, but remains in Laconia, N.H. . . . **Sid Hess** is still teaching at Drexel, but is getting more and more nearly retired. He and Grace live in Chadds Ford, Pa., about 30 miles from Philadelphia. Grace is very active with the Rockwood Mansion Museum in Wilmington and recently hosted the local MIT Club for a picnic and tour of the museum.

The Class of 1953 Scholarship Fund recipient for 1994-95 is **Jeffrey Morrow**, '96, from Gorham, Maine. He is a double major in mathematics and music and has a 4.9 cumulative average! Among other things, he is also involved in the Concert Band (president), the Marching Band (director), the Premiere Orchestra (guest conductor, personnel manager, and artistic board member) and intramural hockey and softball. It is heartening to see that our contributions are assisting such a talented and outstanding person.

George Abbott recently retired from his position as executive VP of Kobelco Metal Powder of America, Inc. He has been involved in the field of powder metallurgy for 35 years while at A.O. Smith Corp., A.O. Smith-Inland, Inc., and Kobelco. . . . **Joe Mullen** and **Rita** moved from Hawaii to Salinas, Calif., about three years ago and are now living in Sun City, Fla., where he continues his consulting business in the design and maintenance of utility and large steam plants. He also commutes to his office in Hawaii, as needed. Joe worked for C-E (now ABB-Brown Boveri) for 25 years before "retiring" in 1975 to start his consulting business. . . . **Dixon Chandley** is technical VP of Hitchiner Mfg. Co., president of Metal Casting Technology, and a director of both companies. He has been awarded 35 patents and is "still counting." However, he also takes more time now for golf, tennis, skiing, and scuba diving, although he has no intention of retiring in this century. Dixon has four children and five grandchildren and lives in Milford, N.H.

I am very saddened to report the death of **Robert Ebeling** in a residence fire in July 1995 in Omtelaunee Township, Pa. He left his wife, Margaret, four children, and eleven grandchildren. Ebeling received a master's in chemical engineering from MIT in 1953 and was employed at various times by Proctor & Gamble, Ebeling & Reuss (a family business), United Technologies, Air Products & Chemicals, and Gilbert Associates. Most recently, he had been a self-employed computer systems consultant in southeastern Pennsylvania and the proprietor of Ebeling Lock, Stock, and Barrel, a dealer in fine antique rifles. The Ebelings have been very active in the Mormon Church and had been about to leave on a two-year mission to work with the deaf in Rochester, N.Y.

I look forward to hearing from all of the Class of 1953.—**Joe Cahn**, secretary, 20 Ocean Park Blvd., Unit #9, Santa Monica, CA 90405-3557; tel: (310) 396-6322; fax: (310) 553-0687; e-mail: <jmc20@aol.com>

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Everyone in the class seems to be quietly (very quietly) pursuing life with little if any newsworthy events. At least we haven't heard from anyone for a long time. Please scribble

a note and drop it in the mail or fax it to me at (203) 576-4766. All of us will be interested in knowing that there still is life out there.

Word has come that **Jim Hazard** retired in March 1994. He is now doing a volunteer project at Friend's Library, Swarthmore College. He is also devoting time to building furniture and playing golf and tennis. With two grandsons and a granddaughter, Jim has begun a genealogy project to fill up the rest of his time. Before retiring, Jim was chief technologist for Scott Paper Co.

We have also received word of several deaths. **Don North** died in early February. He had been a project engineer at MIT. . . . **Ernest Abrahamson** passed away in late March. He had retired a few years ago from his position as chief metallurgist at the Portsmouth Naval Shipyard. He contributed some 40 technical articles to his profession and had several patents. . . . **Shirley and Dick Morley's** son, Robert, died in August at age 31 after a long illness. Our sincere sympathy goes to Jane Abrahamson and to Dick and Shirley.—**Edwin G. Eigel, Jr.**, secretary, 33 Pepperbush Ln., Fairfield, CT 06430

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Paul Attridge has been an independent insurance agent for his entire career, in the Boston and New England area, specializing in the transportation industry. Currently he is Senior VP of

Deland, Gibson Insurance Associates in Wellesley, Mass., an independent general insurance agency. Paul is a director and officer of the Massachusetts Motor Transportation Assoc., and director of the Mass. Movers Association. He has been active with the American Trucking Associations, currently serving as an official with the Annual National Truck Driving Championships. He also is a past president of the Boston Board of Fire Underwriters. He has been active in Needham where he and his wife, Polly, and daughter, Jody, have resided. For 34 years he has been an elected town meeting member, and for the past ten years he has served as the parade marshal of Needham's 4th of July parade. Paul has been very active in MIT and class affairs. Since 1990, he has been our class treasurer, and for the five years prior to that was our class president.

For over 36 years, **Ted Papastravos** has been employed at Ionics, Inc., a separations technology company, and currently is VP for strategic planning and treasurer. He joined Ionics on the advice of Ed Gilliland, who then was chairman of Course X as well as president of Ionics. After starting as a small company, Ionics has grown to employ over 1,300 worldwide with revenues in excess of \$200 million. Ted has no present plans for retirement but has been devoting lots of time to class affairs of late. He and **Joe Saliba** co-chaired our 40th Reunion Committee. Currently he and **Bob Greene** serve as our class VPs, and Ted also serves as our class agent, succeeding **Pete Toohy** who had served so ably in that capacity for 35 years.

Bob Greene continues at MIT as associate director of administration and operations at

the Media Laboratory. He and his wife, Edie, divide their time between an active life in Cambridge and the more relaxed one at their home on Cape Cod. Since 1990, Bob has been a class VP, and for the five years prior to that he and **Duwayne Peterson** were our class secretaries. Since then, Bob has been a great source of news for your current secretary, for which we are most grateful. He also co-chaired our highly successful 35th Reunion with **Joe Saliba**.

As we progress into the new year, we would remind you that we need to hear from you—our news is only as current and interesting as you help make it. So share your adventures and doings with us, and we will pass the news on to our classmates.—Co-secretaries: **Roy M. Salzman**, P.O. Box 197, Rockport, ME 04856-1097; **James H. Eacker**, 3619 Folly Quarter Rd., Ellicott City, MD 21042

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40th Reunion

Paul Hamburger is enjoying his new position as VP of R&D at Hammer Techno-

gies, a Teradyne entrepreneurial unit. The company makes a programmable tester for computer telephony systems. Paul is also leading a long-range planning committee for Lexington, Mass., in his spare time. He and his wife, Paula, play tennis and often visit with their two Brooklyn based children. . . .

Richard M. Powell has been inducted into the Bakken Society, the Medtronic Co.'s highest technical honor in the field of developing medical devices. Richard is the manager of programmer advanced concepts. His work underlies customer-focused concepts embodied in the Medtronic 9790 programmer used by physicians to adjust implanted Medtronic pacemakers and defibrillators to the needs of their patients. This advanced programmer, widely hailed by the world's cardiologists for its ease of use, includes a common user interface to standardize menus and commands. He previously contributed the auto-threshold concept, a major advancement incorporated in all modern Medtronic pacemakers. He is a resident of Bloomington, Minn.

John E. Sirmalis of Barrington, R.I., has been named technical director of the Naval

Undersea Warfare Center (NUWC). A member of the federal government's Senior Executive Service, John has held the position in an acting capacity since last February. NUWC, with headquarters in Newport, R.I., has two divisions, namely, the East Coast division, also located in Newport, and its West



John Sirmalis

Coast division in Keyport, Wash. John's leadership responsibilities entail both current and future undersea warfare capabilities of the U.S. Navy directly affecting the nation's defense posture. As technical director, he is responsible for the planning and execution of technical programs that involve some 6,300 civilian employees and a budget of \$1.1 bil-

lion. He provides management and technical direction for all science and technology invitations assigned to the command. He also directs NUWC planning, investment, business, and information resources management.

John is active in community affairs and was recently appointed by Rhode Island's governor to the state's newly formed Economic Strategy Council. The group is forming strategies for economic growth in Rhode Island.

Andrew J. Viturbi is CTO of Qualcomm, Inc. He will be the featured speaker in the MIT Laboratory for Computer Science Distinguished Lecture Series on February 8 in Building 34, Room 101, 50 Vassar St. at 3:30 p.m. The topic is "A Fresh Look at the Terrestrial Mobil Multiple Access Networks."—**Ralph A. Kohl**, secretary, 54 Bound Brook Rd., Newton, MA 02161; e-mail: <kohl@ll.mit.edu>

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Please send news for this column to:
John Christian, secretary
7 Union Wharf
Boston, MA 02109

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Jack Shelton reports from Littleton, Colo., that he is enjoying retirement more than he ever anticipated that he would. He spent many years with Amoco in production

research, engineering, and engineering consulting, first in Oklahoma and then in Colorado where he and Joyce decided to remain after retirement. The fact that their two children and three grandchildren all live within an 80-mile radius of Littleton probably had a bit to do with that decision.

Jack and Joyce are busy restoring their house, which he claims really needs it considering the cumulative wear and tear incurred while raising their children. His interest in woodworking is apparently serving him well in this effort. In his spare time Jack also does a lot of photography. He and Joyce toured southern France during the summer of '95. Also, they had a marvelous time at the 35th Reunion and are eagerly looking forward to being at the 40th!

Please send your news to:—**Gary Fallick**, secretary, 4 Diehl Rd., Lexington, MA 02173

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This is a brief Class Notes submission, just to let you know that your secretary still exists—the mailbox has been very empty recently, which means that I am soliciting

news from any and all classmates!

Recently, Ginny and I had the pleasure of a few hours with Sarah and Dixon Browder, combining business and pleasure for a late summer tour through New England. Dix is looking great, still works for Hewlett Packard in Santa Rosa, Calif., and they seemed to be enjoying a relaxing and agenda-less vacation. Also, I had dinner with Alfredo Kniazzezh in Newton, who is also doing well and continues with Polaroid.

Chuck Staples has been doing a lot of traveling and has recently been to Thailand where he saw **Adul Pinsuvana**. We would love to hear more!

I've been very busy (along with Ginny) with our systems-thinking consulting firm, GKA,

Inc., and are trying to cope with a very stimulating business environment as well as moving our offices to a larger complex in Cambridge. We are going to France (business) and Italy (pleasure) in November, as we teach a segment on systems thinking and simulation at the Theseus Institute, an international business school, outside of Nice. Tough work, but someone has to do it.

Sorry to be so brief, but that is up to you. Thus, I continue to ask, beg, and implore you to *actually do it*—send an update, which will be most appreciated by your classmates. Hope to hear from you soon.—**Dave Packer**, secretary, 31 The Great Road, Bedford, MA 01730; tel: (617) 275-4056; e-mail: <70421.1766@compuserve.com>

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Your disappointed secretary has little to report this month. Neither the Alumni/ae Office nor I received any updates, except for some e-mail from two of our professor class-

mates, **Rob Stengel** at Princeton and **Dick Bradt** at the University of Alabama. You can reach Rob at <stengel@princeton.edu> and Dick at <rcbradt@coe.eng.ua.edu>. You also may enjoy looking at Rob's home page at <http://www.princeton.edu/~stengel/>.

With so little good news to report, it is especially sad to report the death of a classmate, **Roger Baust** of Southboro, Mass., on September 6, 1995. Roger retired from Digital Equipment Corp. in 1992, and was the owner of RTB Associates, a counseling business. He also was a photographer, and he taught photography in Southboro. Roger leaves his wife, Susan, and a son and a daughter. The deepest sympathies of our class go to his family.

Before I conclude this abbreviated column (please send me some words for future Class Notes!), as class agent I want to compliment you for the excellent support of this year's Alumni/ae Fund. We are off to a great non-reunion fund year and I hope that those of you who have yet to contribute will be generous before the June 30 deadline.—**Frank A. Tapparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204; e-mail: <ftapparo@lmi.org> or <ftapparo@aol.com>

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35th Reunion

Please send news for this column to: **Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167; fax: (617) 734-5230; e-mail: <andrewb820@aol.com>

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Following is the double column we promised you last issue. We apologize for the lateness of the first portion of this news, which made the deadline for the January issue

but was misplaced at the Review office.—Ed.

Jerry Winston dropped me an e-mail message to report another success for the MIT1962 e-mail network. **Dave Bragdon** and **Warren Zapol** both contacted him after his inquiry about visiting Boston/Cambridge in November, 1995, after many years of living in Australia. Jerry contin-

ClassNotes

ues to work with the Canadian Evaluation Society and the American Evaluation Society, planning for a large representation from the Australasian Evaluation Society at the First World Conference on Evaluation scheduled for November 1995, in Vancouver, B.C. Jerry's interests include evaluation of government-funded programs, evaluation of programs conducted by and for indigenous peoples, and data analysis for program evaluation. He would be pleased to hear from other professionals with similar interests. Jerry's latest venture is working with the Institute of Public Administration (INTAN) in Malaysia to establish an Internet discussion group to be called GOVEVAL. Focus of the group will be international issues in public-sector evaluation. This should be up and running in October 1995. Contact <jwinston@rmit.edu.au> for more information on GOVEVAL.

Pete Maas is on a seven-month sabbatical leave from the Department of Physics and Applied Physics at Strathclyde University in Glasgow, Scotland (UK). He is visiting the Biophysics Group at Los Alamos National Lab (LANL). Pete's been working with the section at LANL that is developing SQUID sensors for MEG/MCG (magnetoencephalography and magnetocardiography). He is happy to be able to work all day, every day in the lab again—for awhile—no admin, no funding worries, no grant applications, no students—those things that constantly occupy the time of college professors. In Pete's words: "It's a real chance to recharge the psychological batteries, learn new things, and to review what you have been doing and where you'd like to be going." Pete's family has remained behind in Glasgow, so they miss the chance to visit the nice mountain country around Los Alamos. Oldest daughter, Katja, is running her own graphic design business after graduating from the Glasgow School of Art several years ago. Pete's youngest daughter returned from California several years ago and has graduated from the Law School at Strathclyde this past summer. (Mary and **Hank McCarl** were in Glasgow at about that time and just missed catching up with Pete at the Strathclyde University graduation ceremonies on July 13, 1995.) Pete's wife is looking after their two grandchildren by day and writing and teaching modern dance by night. At Strathclyde University, Pete is a member of the superconducting devices group, which divides its efforts between designing and building SQUIDS and applying them in clinical biomagnetic measurements, non-destructive evaluation of structural defects, gravity gradiometry, and other areas. His particular focus is in the development of instrumentation for biomedical applications. Pete stays in touch via <p.maas@strath.ac.uk>.

Ed Feustal passed along an e-mail message from **Dave Carey** that mentioned Dave's work at the Fermi National Accelerator Laboratory (FNAL) in Batavia, Ill. Dave has been at FNAL for 26 years. Aside from his work in high-energy physics, Dave has become a nationally ranked birdwatcher at 590 species in the continental U.S. and Canada. About 10 years ago he was a nationally ranked master's swimmer, finishing 7th in the 200-meter breaststroke in his age category. Dave also holds the title of

secretary general of the Federation of American Statisticians of Track (as in track and field). His daughter is majoring in music at Indiana University and plans to teach music in junior or senior high school after graduation.

On a sadder note, Ed Feustal passed along a message from Dan Thornhill, concerning his struggle with colon cancer that has spread to various other sites in his body. I passed along the full message on the MIT1962 e-mail network, but it reveals the joy and support that Dan has found in his religious faith as he struggles with the cancer. Dan is hopeful about the treatment but needs our prayers and concern. He may be contacted by mail at 21 Harlow St., #2, Arlington, MA 02174 or by e-mail at <102514.2110@compuserve.com>...

Bob Anderson, formerly president and CEO of Genrad, dropped me a note with a news release about his appointment to the boards of directors at LeCroy Corp. in Chestnut Ridge, N.Y., and Boreas, Inc. in Billerica, Mass., Bob is currently president of Omnigen, Inc., which provides advisory services to CEOs of various technology companies. LeCroy is an \$80 million revenue private company that manufactures digital oscilloscopes and high-speed data acquisition equipment, and plans an Initial Public Offering (IPO) in the fall of 1995. Boreas has developed a 4.2 Kelvin cryogenic cooler used to cool superconductors to operating temperatures. Bob also serves on the boards of ATN Microwave, Inc., Cambridge Physics Outlet, Inc., as well as the Technology Capital Network at MIT, the National Association of Corporate Directors (New England), the Association for Corporate Growth (Boston), and in his spare time he is also president of the board

of directors of Indian Hill Arts, Inc., a not-for-profit music school and professional symphony orchestra. With all this activity, Bob didn't have time to type or scan the news release onto the Internet, so he just dropped it in the mail with a note saying that he does enjoy receiving our Class Notes via MIT1962.

Timothy P. Coffey, director of research for the Naval Research Laboratory (NRL) since 1982, was awarded the Presidential rank of distinguished executive in the senior executive service in a ceremony held on June 26, 1995, at the Pentagon. According to the citation, Dr. Coffey was recognized for his "sustained extraordinary accomplishment in management of programs of the United States Government and for leadership exemplifying the highest standards of service to the public, reflecting credit on the career civil service." Tim is one of the few Navy employees who has received this prestigious award twice. He received the DOD Distinguished Civil Service Award in 1992, and the Fahrney Medal from the Franklin Institute in 1991 for his research in atmospheric physics and related plasmas and for his management of the Naval Research Lab. He began work at the NRL in 1971 as a research physicist.

John Prussing sends via e-mail that he persists at the University of Illinois at Urbana-Champaign as professor of aeronautical and astronautical engineering. He has an active research program, enjoys teaching, playing tennis and piano. His wife of 30 years, Laurel, is beginning her campaign for the U. S. Congress. The election isn't until November 1996, but these things take a long time. Laurel served in the Illinois legislature until the

1994 election. Apart from the issues of the campaign, the biggest early concern is fundraising. The congressional district is quite large, comprising 11 counties. Needless to say, the campaign has had a profound effect on the entire household. John and Laurel's oldest daughter, Heidi, is married and lives in Indiana; she is a computer science grad student and her husband teaches history at a small liberal arts college. Their middle daughter, Erica, is living on the Northern Cheyenne Reservation in Montana, doing field work for a PhD in anthropology. Their youngest, Nickie, is majoring in history at Indiana University in Bloomington.

Ollie Smoot dropped me an e-mail message to let us know that the AAAS has just put on the Web an HTML version of a freely interpretative report for a project that he helped launch and conduct through the National Conference of Lawyers and Scientists on which he serves an ABA member. You can point to <<http://www.aaas.org/spp/welcome.htm>> to see it. He notes that the report's writer was allowed to take a very different approach and the presentation tries to use Web features to make it interesting to the average browser. Ollie hopes that the report is successful in getting its point across to the average Web browser. Take it out for a spin on the Information Superhighway and see if you like it!

Vic Caravito has been in touch just to check out the new e-mail address. Yes, Vic, the message really did avoid becoming roadkill on the information superhighway. Now let's hope that the rest of the class can adjust to my new e-mail connections and keep those messages coming in for our Class Notes column.

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with your classmates, please telecommunicate with: <mit1962@mitvma.mit.edu>. Alternatively, you can send a message directly to me at: <busf038@uabdp.dpo.uab.edu>. If you still communicate via the USPS, or don't have time to type or scan your printed messages, please send your class news and personal notes to: **Hank McCarl**, secretary, P.O. Box 352, Birmingham, AL 35201-0352.

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Please send news for this column to: **Shoel M. Cohen**, secretary, Dept. of Psychology, Nassau Community College, Garden City, NY 11530; tel: (516) 489-6465 (h); e-mail:

<71271.2627@compuserve.com>

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Please send news for this column to: **Bill Ribich**, secretary, 18 Revere St., Lexington, MA 02173; tel: (617) 862-3617; fax: (617) 890-4084; e-mail: <mit1964@mitvma.mit.edu>

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Jim Pepe reports that Gensym Corp. continues to grow. It's quite a change from the large-company environment at DEC. Jim is currently VP of product development at Gensym. Jim

and wife Rosemary have bought a place on Martha's Vineyard, which they avoid during the summer crowds. They recently spent a weekend there with Brenda and **Matt Mleziva**.

Speaking of small companies, **George McQuilken** gave the class quite a lift when he got his picture in the *Boston Globe* demonstrating kick boxing! George's latest entrepreneurial effort is a long way from software—he's lobbying the Massachusetts legislature to allow the sport. The quote of the year: "What's left for the less affluent entrepreneur if he can't afford his own basketball team or to finance an America's Cup racing boat—kick boxing."

Jonathan Addeleston has been named CTO at BDM International. He had previously been VP of software engineering at PRC. Jonathan and his wife, Edie, live in Reston with their two children.—**George McKinney**, secretary, 33 Old Orchard Rd., Chestnut Hill, MA 02167; tel: (617) 232-4710; e-mail: <georgemck@aol.com>

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30th Reunion

Martin Melnick writes that after spending nearly 27 years on defense products he is now

working on TRW's ODYSSEY Program, the company's new thrust into the commercial satellite-telecommunications business. Martin is responsible for managing the development and production of the satellite payload electronics and user portable fixed-base terminals. He can actually talk to people about what he is working on for a change.

A call for the whereabouts of missing classmates found us **Charles Newlander** in San Jose, Calif. He is working on a project involving the conversion of natural gas to electricity without

burning. . . . A few months ago we noted that **Tim Carney** had been nominated by the president to be ambassador to Sudan. He is now fully fledged as ambassador. **Lynwood Robinson** and his wife, Sheila, joined Tim and his family at the official swearing in ceremony in D.C. and for lunch in an antique-bedecked State Department formal dining room. A later ceremony included a guard of honor, national anthems, and a formal exchange of speeches, followed by private talks.

The Tech recently featured a long interview with **Nicholas Negroponte**, director of the Media Laboratory at MIT for its first 10 years. The lab's newest project is called, "Things That Think." One goal is to imbue computing into a common object so it will perform better or give it a personality such that it performs better. The second is to get the object to do things it couldn't do before. He is talking about mundane household items, i.e., door-knobs, sneakers, etc. For more of his fascinating ideas, you can find his column in *Wired* magazine or read his book, *Being Digital*.

Well, we aren't quite up to the Media Lab, but a few years ago we began our entry into the electronic age with an e-mail address for letters to this column and then an e-mail list-serv for the class. Now we have gone farther into cyberspace with our very own home page. **Steve Weiss** volunteered to produce and maintain a page for our class, at least until the reunion in June. If you are a new reader of *Technology Review* and want to catch up on old news, he has incorporated a few years of back columns. We will try to keep updated reunion plans and ideas there as well. You can check it out on the web at <http://web.mit.edu/alum/www/Class/MIT1966/> and can send Steve suggestions or comments at: <srw@cyberspace.org> —**Eleanore Klepser**, secretary, 84 Northledge Dr., Snyder, NY 14226-4056; e-mail: <vismit66@ubvms.cc.buffalo.edu>

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Please send news for this column to: **Charlotte and Jim Swanson**, co-secretaries, 878 Hoffman Terr., Los Altos, CA 94024; e-mail: <jswanson@lat.com>

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Please send news for this column to: **Gail and Mike Marcus**, co-secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818; e-mail: <ghm@nrc.gov> and <mrmarcus@fcc.gov>

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Please send news for this column to: **Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304; e-mail: <76570.2270@compuserve.com>

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We have no mail via the United States postal service, so Karen contacted **Bill Kindel**, the ever-helpful keeper of our class e-mail list, for some

ClassNotes

e-mail, and we were overwhelmed with the rapid responses. In fact, we will have to save many for the next issue. Bill writes, "Like some others of the class, my wife, Dawn, and I enjoy our 'empty nest.' Our son Bob graduated with the MIT Class of '95 (Course XVI) last June and is working toward a doctorate in Aero and Astro at Stanford, courtesy of the National Science Foundation. Our son Steve is a sophomore at Washington University at St. Louis, where he studies engineering, but hasn't yet declared a major. After 11 years at Honeywell and seven at Digital, I spent the last two years as a senior research engineer with the Open Software Foundation Research Institute in MIT's backyard, sunny Kendall Square, doing sponsored research and advanced development of microkernel technology (underpinnings for operating systems), with an emphasis on building high-trust (provably secure) systems. I've had the pleasure of 'editing' the class e-mail list for the past year and I like to think it contributed to the outstanding success of our 25th Reunion last June. (The committee deserves most of the credit, though.) The list now numbers 195 members, which is pretty good for a bunch of 'old fogeys.' My goal is to have all of the class members who have e-mail accounts connected, so we're not there yet. Please send e-mail to me <kindel@osf.org> or to the list <MIT1970@mitvma.mit.edu>, and I will be happy to add you. (By the time this is published, we also hope to have a World Wide Web homepage for the class.)"

Eric Clemons is studying the implications of information technology (IT) with three studies under way: "One addresses the potential future impacts of electronic distribution ('cybershopping') and the implications for the profitability of manufacturers, traditional retailers, and new information middlemen like Microsoft or Prodigy. A second involves the impact of IT on newly contestable markets and studies the sustainable disadvantage of established competitors in telecommunications, banking, and insurance. The third addresses the social and societal disruptions caused by rapid information technology innovation; what happens if we adopt technology faster than individuals can adapt to it. I found our reunion a profoundly cathartic experience (a word I haven't used since a 21.01 paper!)—I am able to confront my memories of the '60s for the first time, and for the first time I have allowed myself to buy '60s records. The CDs in my car now include Country Joe and the Fish, the Grateful Dead, Credence Clearwater, the Stones, and the Beatles, and of course, 'Life, Love, and Antelopes,' by our designated class musician, **Alan Chapman**."

We received this report from **Jim Duggan**: "I hate to think how long it has been since I sent any notes in. I would guess 15 years! We were unable to make the Boston reunion, but we had a mini-reunion in Monterey, Calif., in late June with many of the folks from my living group (Phi Sigma Kappa). We also met a half dozen or so of the guys (now families)

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from '66 to '71: Chuck Hottinger, '66, Jack Wu, '67, Vern Altman, '71, Dana Seccombe, Tom Liu, Ronnie Patton, Duane Shinnick, Mike Venturino, Joe Litton, '71, Bruce Heflinger, '67, and Dennis Bickford—and I'm sure I left someone out. Oddly, although hairlines, waistlines, and other features had dramatically changed, voices seemed to have remained the same. To the amazement and consternation of the crowd, we even serenaded the Carmel sunset with a few old songs from the dinner tables of Beacon Street circa 1966.

... I suppose that you have heard of the passing of Kant Rao. He had been a professor in the management school at Penn State. We had hoped that he would have been able to come to Monterey, but he fell ill shortly before the get-together. ... I write analysis of software companies (packaged applications and application development tools) for a joint venture of First Albany Corp. and the META Group. I live in North Carolina, commuting to Stamford, Conn., and elsewhere in pursuit of wisdom for the institutional investor. Past engagements include stints with Seer Technologies, ten years with IBM, six years with Owens-Corning, and stands with the Air Force and my own software retailing firm. I have been a client of Tony Picardi's on occasion and really regret missing his presentation of the class survey. With the exception of a couple of disputable assignments in the Air Force, I have avoided any direct application of my Course XVI (Aero and Astro) training. It sure has come in handy as an ME, ChE and EE though. I've been married 24 years to Lynn Cryer (B.U. '70). Our older son, Ian, is a junior at MIT (Course VI). Our younger son, Jordan, just started at North Carolina State in engineering."

Steve Barr writes, "Pam Whitman is in the Hague, Holland, studying a European style of art therapy. This is her third of six trips over three years. Her husband, Steve, holds down the fort in Tahoe City, Calif., practicing acupuncture and watching the kids." ... From Don Edwards: "I spent two weeks in Britain in September 1995: a week at St. Andrews working at the Gatty Marine Lab (on the other beach at the other end of town from the British Open) and a week in Cambridge at a scientific meeting. I got to sit at the 'high table' for the main meeting dinner at Trinity College, beneath portraits of Issac Newton, Andrew Huxley (sliding filament theory of muscle contraction), and Alan Hodgkin (nerve conduction), all former masters of the college. Outside of the reunion, this was the high point of the year." ... From Tom Hafer: "We (my wife, 16-year-old son, and 14-year-old daughter) are planning on taking a family sabbatical next summer. We will take a car trip around the United States during July and August. We are looking for a couple of 'absolutely must do' ideas (best raft trip, best dude ranch, etc.). Any ideas?" ... John Huchra writes, "Rebecca Henderson, '81, and I are expecting our first child. We've just moved into a new house in Lexington after living in the depths of Cambridge for four years. I figure this will keep me off the streets (and mountain tops) at night!"

Please keep writing and e-mailing, and we'll try to keep printing!—Greg and Karen Arenson, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023; e-mail: <dhbm13d@prodigy.com>

71 25th Reunion

Our 25th Reunion is in June. If you haven't already done so, please make plans to attend to see you old classmates. There are always gains and losses at reunions: some of us have gained weight and lost hair. Please attend.—R. Hal Moorman, secretary, P.O. Box 1808, Brenham, TX 77834-1808

72 Please send news for this column to: Wendy Elaine Erb, co-secretary, 6001 Pelican Bay Blvd., #1001, Naples, FL 33963; Dick Fletcher, co-secretary, 135 West St., Braintree, MA 02184; tel: (617) 843-5864

73 Please send news for this column to: Robert M.O. Sutton, Sr., secretary, "Chapel Hill," 7721 Churchill Ct., Marshall, VA 22115; e-mail: <sutton@smp.prcmail.prc.com>

74 Paul Pangaro is the first to send us his Universal Resource Locator (URL). Check out <http://www.pangaro.com/~pangaro>.

Alex Siapkaro writes from Greece where he has been working as an education and sociometric consultant in the GR Department of Cultural and Scientific Affairs since 1982. Two years ago he was elected assistant to the dean of academic policy and planning at the National Technical University of Athens. Alex married Harriet Piperopoulos, CE '79, and they have a two-year-old daughter. Alex still dreams in the realms of idealism, structuring applied math concepts, and computer hacking.

Al Lakin and his wife, Sandra (Fisher), '75, Course XVI-B, celebrated their 21st anniversary last summer. They have two sons: Paul (14) and Andrew (9). Both boys play soccer, and Dad is a referee for which his experience as an IM-B league referee prepared him well. Al is the business manager and legal counsel for DEMI, a small R&D firm in Santa Barbara. They're developing low-cost, low-mass batteries for electric cars, and his company is competing to supply the batteries for the Zero Emissions Vehicle requirements in California and the Northeast. Al runs the business side of the operation, including legal affairs, personnel, payroll and accounting, purchasing, patents and licenses, worker health and safety, environmental planning, and public relations. Maybe it's not a surprise that Al's small sailboat doesn't get enough use. He is still active in the U.S. Power Squadron, currently as local squadron commander. With draft lottery number (353), he doesn't expect to wear any other uniform. Does anyone else remember their lottery number? Al thinks he has the lowest number in our class. Write a letter if your number is lower. Send e-mail if your number is higher. Note my new e-mail address.—Barry N. Nelson, co-secretary, 65 Hillside Ave., W. Newton, MA 02165-2543; tel: (508) 663-7598 x1524; e-mail: <barryn@world.std.com>

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Please send news for this column to:
Jennifer Gordon, secretary
 18 Montgomery Pl.
 Brooklyn, NY 11215

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20th Reunion

The news has been very scanty. Please communicate!

You can reach your secretary

through every medium: classic mail, e-mail, fax, or voice. Send news; for many classmates, it will be the first piece of news in almost 20 years. Surely in that period of time those of you who have not been in the Notes have had a few ups and downs to write about. . . .

Weng Chew was kind enough to answer my e-mail plea for some news: "I have been pro-fessing at the University of Illinois at Urbana-Champaign for 10 years now. When I left the 'Tute in 1981 after my PhD and post-doc, I worked in Connecticut for Schlumberger, an oil exploration company. The attraction of academia spurred me to drive west with my family to Champaign-Urbana in 1985. My daughter, Amy, attends University High School, and my son, Ethan, is in sixth grade. My wife, Chew-Chin, PhD '81, works part time at the University."

Mike Golan "went to Alaska with Jan and Mom and Dad for a two-week cruise/land package. One word of advice: find a small ship to cruise on—you'll miss Alaska on a big ship! We went on the *Spirit of Alaska*, a 145-foot, 85-passenger ship. We went into places the big ships couldn't, and we saw wildlife they missed. One afternoon we stopped for about a hour to watch a pod of about 15 orcas, while one of the Princess ships cruised by way off on the horizon. I've left Data General after almost eight years, and I'm now with a small-system integrator, doing database servers and Web servers on Unix as well as CAD/CAE and product data management. Much more dynamic and stimulating than Data General was the last couple of years. If anyone out there needs Unix servers with lots of disk, look at <<http://www.wsi.com>>." . . . **Stephanie Orellana** writes, "My husband and I are on the faculty of Case Western Reserve University in Cleveland, Ohio."

We are coming upon our 20th Reunion this June. We are in dire need of volunteers to help plan activities, in conjunction with the Alumni/ae Association. For those interested in working on this epochal event, please contact **Tom Martin**, Caroline Thomas of the Alumni/ae Association (<cmthomas@mit.edu>), or myself. The reunion will be one week later than in the past. This will cause our reunion to overlap with Harvard's, among others. This, in turn, may put a squeeze on available hotel space. Reserve early! In the interim, please communicate, and volunteer to help with reunion planning. We urgently need help in both areas.

Because of the public nature of these Notes, we have a security policy of not publishing any classmate's home address, business address, or e-mail addresses, other than the secretary's. We have already had multiple attempts to break into our list-server (all defeated), and your secretary has received

reports of people attempting to pretend to be alumni/ae for various purposes, none good. . . . As for your secretary, between the computer biz (VAR and systems integration) and trading, I kee out some time to sleep. Both businesses have their frustrating, as well as rewarding, moments. The trick is avoiding having these times overlap, a not always possible objective.—**Arthur J. Carp**, secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523; tel: (516) 295-3632; fax: (516) 295-3230; e-mail: <quantalyt@aol.com>

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Please send news for this column to: **Ninamarie Maragioglio**, secretary, 9727 Stipp St. Burke, VA 22105

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Please send news for this column to: **Jim Bidigare**, secretary, 9095 North St. Rd. NW, Newark, OH 43055-9538; tel: (614) 745-2676; fax: (614) 745-5648

79

Peter Dreher sent me nice long letter from Dayton, Ohio, where he has lived for the last four years. Peter spent a year as engineering manager at Ithaca College, during which

he crossed paths with **Jan Hack**, who is a professor of economics at Cornell University. Four years ago, Peter moved to Dayton and linked up with **Bogdan Dawidowicz**, who works at General Motors Delco, where he "invented the latest shock absorber. It has a computer that adjusts the damping so that the car can float over a pothole like a magic carpet." Bogdan and his wife are the parents of a 3-year-old daughter. Peter spent a year as a consultant in GM plant engineering, then started up the Wright Technology Network, licensing patents from Wright-Patterson Air Force Base for American companies.

They also write cooperative research and development agreements for the Base scientists to invent product improvements for American companies. He is active in the MIT Alumni/ae Club of Central Ohio, along with **Scott Holmes**. He recently arranged a meeting at the Dayton headquarters of AT&T Global Information Solutions "to show off technologies to make a non-resident PhD program possible. We demonstrated videophones, Lexis-Nexis software, satellite dishes, the Air Force Institute of Technology's broadcast course work, and the educational offering plans of Cable TV. We called it 'Forming the Virtual MIT.'" Peter was married earlier this year to an elementary school teacher with two small children. Thanks, Peter, for all the news. . . . The October 8 wedding announcements in the *New York Times* included the nuptials of **Robert S. Klein**. Robert is a marketing consultant in Overland Park, Kansas, and has an M.B.A. from Stanford University. His bride, Amy Sussna, is an assistant professor of early childhood education at the University of Missouri in Kansas City. . . . That's all the news this month.—**Sharon Lowenheim**, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

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Please send news for this column to: **Kim Zaugg**, secretary, 549 Fairfield Rd., Canton, MI 48188; tel: (313) 981-1785; e-mail: <vayda@erim.org>

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15th Reunion

Please send news for this column to: **Mike Gerardi**, secretary, 3372 Olive St., Huntington

Park, CA 90255; tel: (213) 587-2929 (h), (310) 203-8080 (w); fax: (310) 203-0567; e-mail: <mmg@jmbm.com>

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Jeff, '81, and **Mary Oehler** have finally done it. After 13 years of wedded bliss, they welcomed into the world **Grant Mitchell Oehler** on September 12, 1995. He

weighed in at 8 lbs. 4³/₄ oz. (That's the first time I've ever seen a fraction reported in the ounces. Must be because they are both Docs that they wanted to get it exact!)

The recipient of the Class of '82 scholarship is **Isaac Hands** from West Bond, Wisc. He is a senior in biology and plans to attend medical school. Thanks for your generosity in giving to the scholarship fund.

Wedding plans were announced for **Masayo Watanabe** and **Jeannine Kreker**. They plan to be married on May 18, 1996. Masayo is a pediatric oncologist.

Tenure at MIT was recently awarded to **Karen Gleason** and **Alexander Slocum**. Karen is an associate professor in the Dept. of Chemical Engineering at MIT. (She is the first tenured female faculty member in this department.) Her expertise is in solid-state nuclear magnetic resonance spectroscopy. Alexander is an associate professor in the Dept. of Mechanical Engineering. He specializes in precision engineering and holds two dozen patents. He is the author of the only widely accepted textbook on precision machine design. Congratulations to you both!

Tanya Sienko finished a PhD in physics from the U. of Illinois at Urbana/Champaign in April 1995. She is still working for the Japanese government as a researcher at the National Institute of Science and Technology Policy. She has just returned from Beijing, where she got dragged in as a translator for one of the Japanese NGO delegations. She ended up translating/interpreting for one of the Japanese ministers as well. ("English/Japanese translating—my Chinese is still at emergency level.") She has been working on writing several reports covering Japanese nanotech efforts—anyone who wants a copy, please contact her at <sienko@nistep.go.jp>. Also, she is interested in knowing if anyone has any contacts at the Boston Museum of Fine Arts? She needs to talk to someone about a possible exhibit next year.

Thomas James spent seven weeks this past summer living in Paris and going to school. He went through Temple University's Summer Study Abroad Program and was enrolled in The Sorbonne's French language and civilization course. Very enjoyable and very worthwhile! He lived in Paris on Boulevard Saint-Michel in a dorm, which took a little getting

used to again! By the way, he did it just because he's always wanted to do something like this, not for work.

Robert Wallace, who has been in The Netherlands for the past several years, is now back in the U.S. and living in New York City. He is an entrepreneur: While maintaining his business in Amsterdam, he is now establishing himself back here in the U.S.

Send notes.—**Helen (Fray) Fanucci**, secretary, 502 Valley Forge Way, Campbell, CA 95008; e-mail: <fangroup@aol.com>

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Good things are worth waiting for. Just ask **Cady Coleman**. On October 28, 1995, at 9:50 a.m., Cady and six other

astronauts were launched into space aboard the Space Shuttle *Columbia*. The mission, STS-73, was NASA's second featuring the U.S. Microgravity Laboratory in the shuttle's payload bay. The launch was completed on the seventh attempt due to a series of postponements for repairs and bad weather.

Some 450 well-wishers, many from MIT, ventured to Kennedy Space Center for the first launch attempt on September 28, 1995. The launch was postponed for mechanical reasons and the repair schedule enabled Cady to come out of quarantine and join 450 guests at a barbecue held in her honor. On October 5 and 6, there were postponements due to weather (Hurricane Opal) and a hydraulic leak in the nose gear respectively. On October 7, the astronauts boarded *Columbia*, but a failure of the master events controller led to a scrub for that day. On October 14, the mission was postponed to inspect for cracks that had been found on another engine (not on *Columbia*). On October 15, bad weather led to a mission scrub after Cady and her crewmates lay on their backs aboard *Columbia* for six hours.

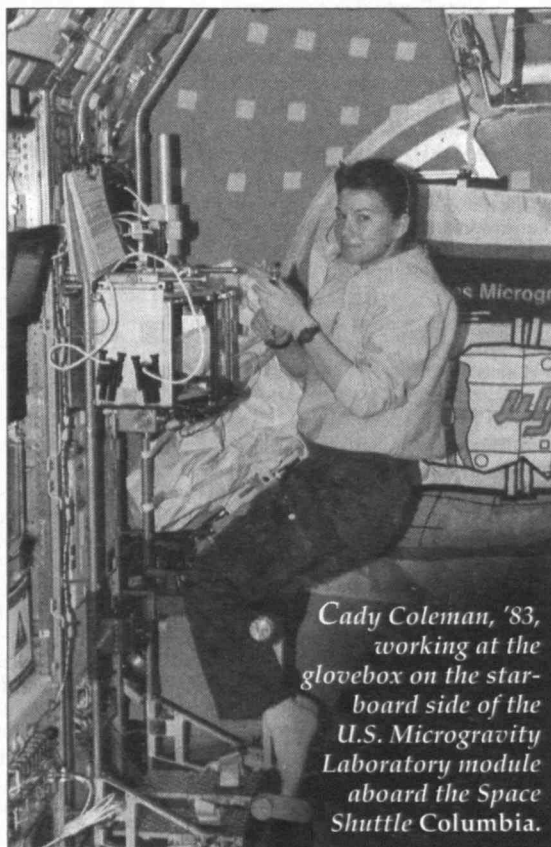
I had the pleasure and very special privilege of watching the liftoff with Cady's family just three miles from Pad 39B. It was raining just 45 minutes before the scheduled launch time, and it appeared that another postponement was possible. However the weather cleared quickly and the count resumed at T minus five minutes. It suddenly became apparent that a launch was likely. This brought about a very strange feeling: We had hoped and prayed for so long just for the launch countdown to continue. Now that it was finally continuing we had to quickly hope and pray for the safety of the crew and success of the mission.

If you want to see the details of the launch, you can watch it on television, but if you want to *experience* a launch, you must go to Kennedy Space Center. It is unbelievably bright and loud, although it takes a good 15 seconds for the sound to travel three miles to the viewing stand. *Columbia's* flight path took it down range away from us enabling us to look right up the engines and exposing us

directly to the loud crackling blast that propels the orbiter into space. Cady was one of three astronauts sitting on the flight deck of the shuttle (the other four have a view of some lockers on the mid deck). She sat behind the commander and the pilot, wearing a mirror on her thigh that enabled her to see the earth falling away through the window over her head. One of her first mission tasks was to take a photograph of the separation of the external fuel tank, just eight minutes into the mission. Just one hour later, she was supposed to go to sleep. I am eager to find out if she did. One hour later on the ground, I was still shaking.

STS 73 is scheduled to be a 16-day mission, which is the longest scheduled mission in space shuttle history. Cady will perform many of the experiments in the Microgravity Laboratory, including protein crystal growth, acoustic levitation, and measuring the flatness of thin films. In addition, Cady is one of two astronauts prepared for a spacewalk, should it be necessary. Many know that Cady holds the Class of 1983 record for sustaining g-Forces and remaining conscious. She set the record, 9 g's, in the g-Force chair at Wright Patterson Air Force Base. Incidentally, this is also a *human* record. Now she is our first classmate in space, something many of us have been accused of, but to date only one of us has achieved.

In other news, **Diane Karalekas**, MD, has joined the staff of the Department of Ophthalmology at the University of Massachusetts Medical Center as an assistant professor of ophthalmology. Diane did her residency in ophthalmology and fellowship training in glaucoma at Northwestern University in Chicago. She went to medical school at Cornell University Medical College. . . . **Dan Schwinn's** Shiva Corp. is planning a follow-on stock offering of 2,500,000 shares. Shiva's



Cady Coleman, '83, working at the glovebox on the starboard side of the U.S. Microgravity Laboratory module aboard the Space Shuttle Columbia.

IPO in November 1994 was priced at \$15 and opened trading at \$30.50. The shares have traded as high as \$63.25. The follow-on offering comes as part of an agreement that would provide liquidity to shareholders of Spider Systems, which Shiva acquired. In addition, proceeds will be used to pay down short-term debt from the acquisition.

Please keep those cards, letters, and faxes coming!—**Jonathan M. Goldstein**, secretary, c/o TA Associates, High Street Tower, 125 High St., Suite 2500, Boston, MA 02110; fax: (617) 574-6728

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Please send news for this column to: **Jonathan Miller**, secretary, 1708 Plaza Ct., Mountain View, CA 94040; tel: (415) 961-2394; fax: (415) 813-1130; e-mail: <logiduke@aol.com>

85

Greetings everyone. News has fallen off a bit, so please submit news by mail, phone, or e-mail. Our colleagues in the evil Class of '86 are continually putting us to shame.

One of our own has made it into the real news of the February 24, 1995, issue of the *Boston Globe*. **Kenneth Granderson** is founder, president, and chief software officer for Inner-City Software in Dorchester. Ken's company recently issued a new interactive CD-ROM based on Robert C. Hayden's book, *African Americans in Boston: More Than 350 Years*. Says Ken, "For a lot of black kids, their reality is their neighborhood. We want to use technology as a door for them to open up the world so they can see there is more to life than Blue Hill Avenue and Columbia Road."

Jon Morrow writes, "For the past year I've been an assistant professor of obstetrics, gynecology, and reproductive science at the Mount Sinai School of Medicine in New York, where I am now the associate director of the OB/GYN residency program. Since July, I've been working half-time so I can go back to school, and I'm now a part-time graduate student at Columbia. I'm in the Medical Informatics Program, which deals with the applications of computer science in medicine. My specific area of interest is computer-based and computer-assisted medical education. This summer I'm taking Columbia's equivalent of 6.001—such fun!"

From **Chuck Lane** we hear that he is now paving the information superhighway. "After 10 years in the materials field (primarily metal matrix composites), I've entered the wild and woolly world of software! Although I truly enjoyed using my Course III education, I've always been a propeller head at heart. Also, the San Diego job market is much stronger in software, hardware, telecom fields than it is in materials/manufacturing. ALPHAREL provides document imaging and workflow management solutions. As a software author and systems integrator, I'm responsible for developing demo software for different market segments and supporting our tradeshow and proposals to customers. I'll miss the international travel of my previous job (especially Italy and Japan), but it's fun here and there are numerous career paths to explore as I delve deeper into C/S and EDMS technologies.

I still try to get in a couple of good tropical vacations each year—most recently the Great Barrier Reef for diving and the North Shore of Maui for surfing. (However, trying to make it to the annual Objectivist conferences have cut into that somewhat.) Next weekend, I'll be competing in the PHRF Area G Sailing Championships. Eventually, I'd like to make time for B-school, but I seem to be better at spending time than making it."

Erik Devereux reports, "I have been named the director of the master's of science in Public Management and Policy Program here at the Heinz School at Carnegie Mellon. This program is our original professional program, and currently has around 130 full-time students in it. As part of this new position, I have left the tenure track and now am a senior lecturer in politics. About 60 percent of my time will be administrative as I manage the MS program. My wife is expecting our first child, due in April 1996."

Julie Forman-Kay is currently a scientist in the Biochemistry Research Division at the Hospital for Sick Children Research Institute in Toronto, and she is cross appointed to the Biochemistry Department at the University of Toronto. She collaborates with her husband, Lewis Kay, also a scientist at the university, using magnetic resonance spectroscopy to study protein interactions.

In the reproduction department we have some announcements: **Cynthia B. Paschal** and **Perry L. Gerenday** are very happy to announce the birth of our daughter Sarah Paschal Gerenday on September 22, 1995, at St. Thomas Hospital, Nashville, Tenn. . . **Brian White** and **Julie Schwedock** announce the birth of their son William Louis White on June 21, 1995, just a couple of days after the reunion. . . **Jim Hutchinson** and **Anne Fricker**, '86, announce the birth of Charles Halsey "Biff" Hutchinson on August 24, 1995.

Send news.—**Bill Messner**, secretary, 5927 Alder St., Pittsburgh, PA 15232-3890; tel: (412) 361-4180; fax: (412) 268-3348; e-mail: <bmessner@cmu.edu>, or Class of 1985 list-serv: <mit1985@mitvma.mit.edu>

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10th Reunion

Stephen G. Hushek and his wife, Laurie, had a son, Benjamin Allen, in July 1994, barely two months after Steve finished a PhD in nuclear engineering at MIT. They moved to Milwaukee later in 1994, and Steve started working at GE Medical Systems as a systems engineer on their Interventional MR (magnetic resonance) project. "We are combining real-time MR imaging with surgery for the operating room of the next century. The back of my head even made it onto the *ABC Evening News* with Peter Jennings when they featured the story." Laurie works part-time as an MR technologist, and the couple "just got back from a trip to Nice (Society of Magnetic Resonance conference) and Paris (vacation) that we enjoyed immensely. Three days in Paris produced three rolls of film and one hour of videotape."

John R. Coffee's update of the past few years starts back in 1991, when he left McDonnell Douglas Helicopter Co. for Orbital Sciences in Chandler, Ariz. In 1993, in addition to working at OSC, he began

ClassNotes

consulting for a small start-up company, Leading Edge Technologies, which is developing remote asset management and vehicle tracking products. In January 1995, he switched roles, working full time at Leading Edge and consulting to OSC instead. Leading Edge Technologies' initial product is a golf yardage and information system called Prolink. The system provides the golfer a roof-mounted color display of the hole he is playing and the distance from his location to the pin and other features of the hole. Precise distance information comes from a GPS-based navigation system in the golf cart. In addition, the course manager has a real-time display of the locations of all the golf carts on the course, which allows him to improve the management of the golf course. The system is currently installed on eight golf courses, with sales of several more expected by the end of the year. At OSC, he designed GPS-based navigation systems for short-range ballistic missiles used as targets for interceptor test flights. The demonstration system, which successfully flew in August, combines a surplus 1970s vintage inertial system with GPS and computer hardware from the 1990s.

Brian Mulcahey married Lydia Hsu (Wellesley, '85) on September 23, 1995. They both had lots of friends from Wellesley and MIT attend. Brian and Lydia also just bought a house in Sudbury, Mass.—"a nice 20+ year old colonial on a wooded lot. Oh, the honeymoon was great, too—a three-week whirlwind tour of six countries in Europe." . . . Navy Lieutenant **Renton Carsley** recently received the Air Medal for his outstanding performance as naval aviator during operations in the Persian Gulf on board the aircraft carrier USS *Dwight D. Eisenhower*. The press release reads, "Displaying exceptional skill and courage, Carsley successfully conducted air patrol and reconnaissance missions in enforcing the 'no fly' zone over southern Iraq. The award is official recognition for skill, courage, and devotion to duty in the face of hazardous flying conditions." . . . Via the miracle of electronic communications, **Peter Falatyn** wrote in from Moscow, Russia, of all places. His Course XVI background and MBA from UCLA (yikes!) brought him to consulting for Western high-technology companies in Moscow. "I am president of a company I founded in 1994, Petersburg International, Inc. (Yes, that's a shameless plug.)" His company represents the business interests of several Western companies in the fields of aerospace, industrial products, and medicine. "I don't sell Russian weapons!" Rather, his business focus is finding Russian-sourced technologies and partners for Western companies. "This focus brings me in touch with numerous Russian design and production organizations, the Ministry of Science and Technology Policy, Ministry of Health, and Ministry of Defense. The MOD may sound intimidating, but they're really very nice people." As of early November, it had been snowing and

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sleeting in Moscow for three days. "So send blankets and cold/flu medicine."

Bob Weiner writes, "After nine fun-filled years at Motorola working in research, on embedded-systems products and in CASE and information-management tools, I've decided to give the small company, startup route a chance." He's moving from Austin, Tex., to Saratoga, Calif. (in Silicon Valley) to join Cubicon Corp., which is developing a "radically new visual, object-oriented software design methodology and toolset." In just the last year or so, Bob's also married a fellow New Orleanian, Kellie Clark, moved to Austin, raised two dogs (Alfred and Hitchcock), had his software published on CD-ROM, all while trying to help people understand the radical paradigm shifts that are just around the corner. He just had a chance to visit MIT for a symposium celebrating the 50th anniversary of Vannevar Bush's original Memex (hypertext) paper. And he's looking forward to seeing everyone at our 10th Reunion.

Speaking of our 10th Reunion and MIT, I'm pleased to pass along a little information for all of you about the recipient of our class's scholarship award. Maria Martinez was chosen as the Class of 1986 Scholar for the '94-'95 school year. She is a senior biology major from San Antonio, Tex., and is interested in a career in research. During summers she has worked at the University of Texas Health Science Center, and in addition to her excellent academic work at MIT, she plays intramural sports, jogs, and enjoys music and art. She lives in Spanish House and also works as a member of the house government group. MIT wishes to thank all alums from '86 who have contributed to our scholarship fund. The continued generosity of so many alumni/ae allows the Institute to sustain its commitment to these fine students.

Last administrative note: If anyone reading this column would like to be added to our class e-mail list, or would like to change your existing e-mail address on record at MIT, please send e-mail directly to: <mitalum@mitvmc.mit.edu>. To submit news items to Class Notes, please write to: Bill Hobbib, secretary, 5 Cappy Cir., W. Newton, MA 02165; e-mail: <mit1986@mitvma.mit.edu> or <billhobbib@aol.com>

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Welcome to this month's column, which was submitted to *Tech Review* very late! I'd like to thank the Class Notes editors for their flexibility. Due to the late date, though, I have

been asked to keep it short, which means that some material will be delayed until next month.

From *Tech Talk* I received a clipping announcing that Jonathan Gruber has been selected as a National Science Foundation Presidential Faculty Fellow. Jonathan was one of 15 winners in this country selected by the NSF, the only one in the social and behavioral sciences, and the first to be received by an MIT faculty member. Currently an associate professor in the Department of Economics, Jonathan's research focuses on health economics and the economic effects of governmental social insurance programs. He has analyzed the effects of a diverse range of insurance programs, including Medicaid, unemployment insurance, workers' compensation, and employer-provided health insurance. After graduating with us from MIT,

Jonathan received a PhD in economics from Harvard University in 1992, at which time he joined the faculty of MIT.

Eric Grote wrote in with the good news that he finished a PhD in cell biology at UC/San Francisco this past September. His thesis topic dealt with synaptic vesicle recycling. He's now doing a postdoctoral fellowship at Yale, where he is trying to build on his previous results using yeast genetics. . . .

Mark Wang received a PhD from the MIT Department of Physics in the summer of 1994 and attended the June 1995 commencement (photo on page MIT 37 of the August/September issue of the *Review*). He married longtime friend Sally Chung (Cornell, MBA '90) in 1993. A year ago, Mark became a policy analyst with the RAND Corp. in Santa Monica and a violinist in the Santa Monica Symphony. Sally and Mark enjoy running and golf, and recently bought a house in Walnut, Calif., where Sally works for ViewSonic. Recently, Eric Twietmeyer visited them in California. Eric is the director of Mathematics and a programmer at Looking Glass Technologies in Cambridge. He earned a PhD in mathematics at Harvard University.

The new book, *Public Access to the Internet*, lists James Keller as one of its two editors. Published by the MIT Press, the book examines the issues involved in ensuring broad access to the Internet as it experiences rapid growth and commercialization. According to the book jacket, James is a research associate and the coordinator for the Harvard Information Infrastructure Project, the organization responsible for the book's publication. . . . Simson Garfinkel and his wife Beth bought a 150-year-old house on Martha's Vineyard. The house has provided quite the challenge. They started off by pulling out the one working shower (they didn't know that at the time) and spent the entire summer showering outdoors! Their count so far is \$50,000 spent on the roof, walls, floors (lots of lead paint) and electrical stuff. But they report that things are starting to shape up with it, and are adjusting to island life. . . . Brad Feld and his wife, Amy Batchelor, moved to Boulder, Colo., this past November. The two companies that he is involved with: net.Genesis (chairman) and Software Business Technologies (on the board of directors) are both on the World Wide Web; Brad invites fellow classmates to check them out at <http://www.netgen.com> and <http://www.sbt.com>.

Todd Malone checks in from Asia, where he works for Knight-Ridder Financial. Based in Hong Kong, Todd frequently travels to Tokyo, Sidney, and Singapore. He has not had any DU or other MIT guests come through yet but would be more than willing to play tour guide. He can be reached via e-mail at <tmalone@hk.super.net>. . . . Michael Foley got married last May to Kelly Voll (Cornell, '90). They met while Michael was living in Rochester, N.Y., where he worked for the Bausch and Lomb Contact Lens Division. MIT Deke alumni/ae in attendance at the wedding were Tom Dorf, '88 (best man), Chris Foley, '91 (groomsman), Ted Devlin (groomsman), Shin Hirose, '90, Steven Hoenig, Jon Kane, Dave Luneau, and Ed DeVoe. The highlights of the day were a Fine Line reunion gig and an all-night hotel party and poker tournament after the reception.

Michael and Kelly honeymooned in St. Lucia. Recently, Michael joined the International Equipment Co. in Needham, Mass., as VP for engineering. The company is a producer of electromechanical equipment for clinical, research, and industrial laboratory applications. . . . **Mark Foringer** is engaged to be married in May 1996. Lori Carlucci, Mark's fiancée, is, like Mark, an engineer and an officer in the Air Force. . . . **Jeff Bigler** writes that he and Nancy Gilman, '89, are engaged and are tentatively planning to be married next October in the Boston area.

Oh, yes, one final bit of news. I finished. I'm now officially Dr. Jack. All I'll say is that it was more like a *braul* than a defense. I plan to remain at USC/Aiken for the time being as an assistant professor of engineering.

A longer column next month, promise!—**Jack Leifer**, secretary, 2908 Roses Run, Aiken, SC 29803; tel: (803) 642-3900(h), (803) 648-6851 (w); (fax): (803) 642-2700; e-mail: <leifer@sc.edu> or <MIT1987@mitvma.mit.edu>

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Hello classmates, all of you must have been out trick-or-treating when this column was due—and as a result, the length of this column is scary!

Brad Fenton, his wife, Cydney, and daughter, Victoria, recently relocated to North Carolina where Brad is currently enjoying a residency in family practice at East Carolina University.

Mary Penniston transferred in May to HP in Chelmsford from Fort Collins, Colo. She got married recently to Michael Salinas, '96.

Please send news to: **Cathy Suriano Singer**, secretary, 131 Main St., Andover, MA 01810-3804; e-mail: <singer@mit.edu>

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Please send news for this column to: **Henry Houh**, secretary, 4 Ames St., Cambridge, MA 02142; tel: (617) 225-6680; fax: (617) 253-2673; e-mail: <hhh@mit.edu>;

Web site: <http://www.tns.lcs.mit.edu/mit89/>

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Greetings from sunny Northern California! I'm still having trouble acclimating to warm weather in the dead of November but somehow I'll find the strength to go on.

Helping me are a ton of MIT grads that have made the migration West. **Penn Loh**, **Andrzej Skoskojewicz**, and I had a great time in Berkeley watching some excellent water polo. Penn is getting ready to head back East after a few years away.

The Bay Area MIT Alumni/ae Club threw a fantastic BBQ in late October and the turnout was excellent. Several of our classmates attended. **Paul Livesay**, after a sting with Wilson Sonsini, is now legal counsel for a data encryption company. **Nikki Skinner** is working for Applied Materials and living in Los Gatos. Never one to be absent from a gig with free beer was **Ning Peng** who is doing quite well now that she's reading this column instead of writing it!

Got a good amount of news for this issue:

Jeff Meyer reports that he has finished two tours with the USAF and is heading to the University of Chicago Graduate School of Business. He writes: "I'm in D.C. now, where I see many DU's on a regular basis—**Mike Dorsch**, **Nabil Istanfanous**, **Chris Massa**, and **Eric Nudelman**. Mike and Chris work at Orbital Sciences, Eric works at Mil3 with a slew of other MIT grads, and Nabil is a lawyer at Crowell and Moring. I plan a stopover in Pittsburgh to visit **Michael Provance** on the way to B-school."

Lorenzo Levi just graduated from Harvard Business School and is working at Bain & Co. in London. . . . **Armando Fox** is alive and well and working on a PhD in computer science at UC Berkeley, where he shares a house with eight other people including **Dan Garcia**, '89, **Ann Guy**, '94, and **Roderick Diaz**, '95. Recently they welcomed **Christina Liu** to Berkeley's Haas School of Business. Toward the end of last semester, he had an informal Baker House reunion. Armando has pictures of this gathering on the WWW at <http://www.cs.berkeley.edu/afox/fulton>.

Howard Weingram is still at Teknekron, working hard on their next big product. **Randy Duran** is working at Teknekron as well. Howard sends along news that "[m]ight be of interest to some of my fellow rowers: **Bill Malecki**, '88, and I talked at Stanford RC, where he has been doing some sculling. I ran into **Bob Martin**, '90, at a bar in San Carlos and **Alisa Mosler**, '91, during Rosh Hashanah."

Mini Gupta is getting an MBA and master's in education at Stanford, worked for KidSoft, educational software distributor, this summer, and plans to return to McKinsey-Atlanta upon graduation. Also at the Stanford B-school is **Alex Rosen**, in his second year.

Vijay Vaitheeswaran writes in saying, "I run into dozens of MIT alumni/ae in my job as the Latin America correspondent for the *Economist* magazine—most of the finance ministers, a bunch of the presidents, and many of the top businessmen have Brass Rats on, which always gets me a warm reception, but I see very few of my own classmates! Please mention to all in Class Notes that if they come down Mexico way, to remember they will get a warm welcome if they drop me an e-mail: <74111.2004@compuserve.com>. Thanks!"

Kay Hsu also sends in quick note: "I am now working for Hewlett-Packard, San Diego. I transferred here two and a half years ago from Hewlett-Packard, Delaware. I am doing ASIC design right now. It's a lot of work and hours. Saw **Frances Lam** and **Sherry Huang** a couple months ago. They both moved from the East Coast to San Diego recently. Sherry Huang got married to **Kai Cheung** last year."

. . . **Yvonne Grierson** dropped me a quick e-mail to report that **Jennie Snyder** was recently married.

That's it for this issue. Keep on sending in the news.—**Max Ochoa**, secretary, Crothers Hall #89B, Stanford, CA 94305; tel: (415) 497-6902; e-mail: <mchoa@leland.stanford.edu>

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5th Reunion

Please send news for this column to: **Andrew Strehle**, secretary, 59 Commonwealth Ave., Apt. 4R,

ClassNotes

Boston, MA 02116; tel: (617) 450-0637; e-mail: **Renee (Mong) Miller**, <miller-rl@post7.laafb.af.mil>

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Suzanne Garber writes that she has moved yet again—back to good ole Cambridge, Mass. She is working for **Sapient Corp.**, a client/server consulting firm. She's hoping that

their plans to open a couple of European offices will fly and then she will move to work in London. It could happen in just a year or two.

Seen: some MIT folks out here in Denver. A little get together of some guys from Delta Tau Delta—**CJ Whelan**, **Matt Hockett**, **Jeff Jacobson**, **Kyle Hanley**, and a couple of other folks. They had great weather and got some hiking in, but I only saw them for an hour.

'91ers I hung out with this past weekend—**Laura Pitone** and **Tom Cole**, who came out for a special visit, and **Lola** and **Rob Lohr**, who recently moved here and plan to be settling in Denver for some time.

Heard through the University of Colorado grapevine: **Linda Sauter** is at CU/Boulder doing graduate work.

That's the news folks. Write to me please!—**Leslie A. Barnett**, secretary, 2644 Vrain St., Denver, CO 80212; e-mail: <labarnet@ouray.cudenver.edu>; tel: (303) 433-4476

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Love is in the air! It seems that many of our classmates are getting engaged or married. Then again, what else is new?

I would like to start this issue of Class Notes by extending my best wishes for a speedy recovery to **Andy Howe**, who at the time of this writing had left his job 10 weeks previously, due to a brain aneurism

Alpha Chi Omega

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lmisterk@student.med.harvard.edu

Write to our special mailing list:
axo10years@mit.edu

Puzzle

Continued from Page MIT 47

times out of 3. After the first H appears the four possible continuations for the next two throws are TT, HH, HT, and TH. Earl wins with TT, Fibo wins with HT and is assured of winning with HH. TH brings the series to a situation equivalent to that existing after the first H appeared.

Garth (THH) defeats Fibo (HHT) 3 times out of 4. Fibo wins when the first three throws are HHT and is assured of winning when the first three throws are HHH. Garth wins when the first three throws are THH and is assured of winning when they are HHT, HTH, THT, TTH, or TTT, since now THH will appear before HHT.

Hal (TTH) defeats Garth (THH) 2 times out of three. This is equivalent to the contest between Fibo (HHT) and Earl (HTT). With fair coins it does not matter which side of a coin is termed heads.

Earl (HTT) defeats Hal (TTH) 3 times out of four. This is equivalent to the contest between Garth (THH) and Fibo (HHT).

George and Susan Blondin remark that a winning strategy is to let your opponent choose his or her horse first and then take the opponents first 2 letters as your last 2 and take the reverse of his middle letter as your first. This is the pattern of Earl, Fibo, Garth, and Hal.

Other Responders

Responses have also been received from R. Hess, H. Hirschland, W. Himmelberger, R. Lenoil, B. McCue, R. Nordstrom, A. Ornstein, E. Passow, R. Raines, K. Rosato, J. Rosenthal, G. Rowsam, D. Savage, L. Schaidler, M. Seidel, S. Shapiro, J. Stiehler, H. Stern, and F. Tydeman.

Proposer's Solution to Speed Problem

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from which he is recovering gradually after emergency surgery. His sense of humor intact, he writes, "I'm currently employed by the Disney Corp. in charge of previewing media. I lay in bed a lot and watch TV, basically. In my spare time I keep up with environmental issues and make calls to congressmen. They hate me."

Kelly Sullivan has had a whirlwind summer. She was engaged to Larson Gunnes, Sloan MBA, '93, three weeks after catching the bouquet at **Patty (Birgeneau) Prince's** wedding. The date of the wedding is still undecided. Later that summer, she went to Martha's Vineyard for her rotation in rural medicine. She reports that she is working hard in her third year at Harvard Medical School, but still has time to get together with friends from MIT: **Patty Prince, Celia (Fleming) Dieterich, Ajanta Guha, '92**, and me.

Mico Perales and Kathy Peck recently got engaged, so she's moving to Houston in October to be with him. He's there working at Texas Instruments. Anyone know of job opportunities in Houston for a technical writer? No date is set yet for the wedding. . . . **Lisa VanDermark** is working for GE Silicones, in upstate New York. . . . **Royce Shin** just got a master's in AI or computer science from U. of Minnesota.

Having completed a master's of science at U. of Illinois in '94, **Miriam Lawler** is now living in Kansas City, Kans., working as an environmental engineer with Burns & McDonnell Waste Consultants. She reports that she is interested in starting an MIT club in the Kansas City area, so if anyone is interested in helping, please contact her! **Miriam** is in touch with a few classmates: **Arun Patel** is in medical school in Mississippi, **Sasha Wood** is in a PhD program at Carnegie Mellon, **Shannon (Mohr) Thornburg** recently moved to Carolinas with her husband, Jon.

Neel Sarkar switched from working at GE to Commonwealth Edison, the power utility in northern Illinois, and is currently living in Chicago working on an MBA at Northwestern's Kellogg School. . . . **Maroula Bratakos** just finished a Course VI MNG in August (she spent a year in Michigan after we graduated and then came back to MIT) and is now working for PCSI in San Diego. For the benefit of those of us still in the cold North, she writes, "The weather here is too good to believe. I keep waiting for it to turn cold." **Maroula** is also starting to swim with a master's group and hopes to join a women's water polo team at the end of October.

An enthusiastic **Andrew McFarland** writes, "I am living in Pensacola, Fla., now and am in my second month of the Navy's Primary Flight School. Training is going well and progressing slower than I'd like (Hurricane Opal and all), but all in all I am happy here." In August, **Andrew** proposed to **Maria Tandoc**, a senior at Boston University. The wedding is set for September 1996.

Larry Smilg was married in May to **Jennifer Peskin**, Lesley College '93, (now Smilg) and they moved into their new home in Ashburn, Va., in September. He has been working at Orbital Sciences Corp. for a year now as a systems engineer on the Pegasus launch vehicle and really enjoys it.

Cyrus Shaoul met **Nicholas Negroponte** when he came to the GII Junior Summit in Tokyo at then end of October but is still trying to find more people from the class of '93

who live in Tokyo. . . . **Hooman Davoudiasl** started his third year of the PhD program in theoretical particle physics at Caltech. Currently he is devoting most of his time to research.

Jon Klaren is working at QUALCOMM, Inc., in San Diego, Calif., designing radio equipment for cellular and PCS wireless infrastructure. Jon enjoys his job—especially the flexible hour—and is becoming accustomed to the great Southern California weather. He is still dating **Monica Dodds**, who has been working for Procter & Gamble's Sundor plant in Anaheim, Calif., since May 1995. Occasionally, Jon gets together with **Meredith McKenzie** who still works for Intel, but is now attending law school in Santa Clara. And the last he heard from **Dan Grana**, Dan was going to be transferred to Merrill Lynch in Mexico City for one year.

Edwin J. Adlerman is still at the University of Oklahoma, working toward a degree in meteorology. He spent much of the spring chasing tornadoes for the second year of the VORTEX field project. It was a much more successful year than 1994, with many great storm days, several broken windshields (from hail), and observations gathered on eight tornadoes. . . . After MIT, **Alice Wei** did some research work at the University of Rochester School of Medicine in the field of Neuroimmunology under David Felten, who also happens to be an MIT alum. She's now a second-year medical student and having a blast at SUNY/Stony Brook on Long Island about an hour away from NYC, so she is always looking for an excuse to drive in. . . . **Terry Tsai** is still working for Sapient but was on site at Merrill Lynch in Manhattan for the greater part of the last six months. He recently moved into a spacious loft near the Boston Beer Works. He adds that his company, Sapient, is looking for new hires. Contact him if you're interested.

Ali Alavi has been working as a software engineer for MicroStrategy, Inc., in the D.C. area since getting an MNG in Course VI a year ago. He's living with his fraternity brothers, **Mark Piesner** and **Jun H. Choi**, '94, in beautiful Arlington, Va. He's working on a cool Web application, and he's looking for people to hire, so let him know if you're interested!

That's all for now. Please let the rest of the class know how you are doing! Write, call, or e-mail me. Get connected! Join the 1993 class e-mail list. Send e-mail to:

<listserv@mitvma.mit.edu>. In the body of the letter write, "SUBSCRIBE MIT1993." You can also write me and I can do it for you. Take care and let me know how you are doing!—**Mari Madsen**, secretary, 85 Alberta Rd., Brookline, MA 02167; tel: (617) 469-3028; e-mail: <mmadsen@opal.tufts.edu>

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Please send news for this column to: **Jeff Van Dyke**, secretary, 6000 Shepherd Mountain Cove, #1401, Austin, TX 78730; e-mail: <jvandyke@lcs.mit.edu>

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Please send news for this column to: **Ranjini Srikanthiah**, secretary, 21 Beacon St., Apt. 2T, Boston, MA 02108; e-mail: <srikanthiah@idx.com>

CourseNews

CIVIL AND ENVIRONMENTAL ENGINEERING

Willie Weiss, SM '80, CE '80, writes: "I joined CSSI, Inc., of Washington, D.C., as a senior systems analyst. I am in charge of the operational analyses performed for the operations research section of the Federal Aviation Administration. Current projects emphasize the operational impacts of new airspace concepts such as direct routes and free flight." . . . **Salvador Miranda-Barreda**, SM '82, of West Vancouver, B.C., reports: "I started a new company, InterAmerica, to promote business with Spanish-speaking countries. I am also doing some software development, business planning, and project management." . . . **Jerome B. York**, SM '61, has left IBM and joined Tracinda Corp. as vice-chairman. In this newly created position, York is involved in Tracinda's current and future investments. Prior to joining IBM in 1993, York spent 14 years at Chrysler. He was named executive VP for finance and CFO in 1990, and was elected to Chrysler's board of directors in 1992. Previously, he held a range of financial and operating management positions at Chrysler, including VP and controller, VP in charge of the Dodge car and truck division, and managing director of Chrysler's operations in Mexico. Before joining Chrysler in 1979, York was president of the Delta Truck Body Co., and group VP of Baker Industries, Inc. Earlier in his career, he held management positions at RCA, Ford, and General Motors. York holds a BS in engineering from the U.S. Military Academy and an MBA in accounting from the University of Michigan. . . . From Tempe, Ariz., **Avi Singhal**, SM '61, CE '62, ScD '64, writes: "I recently served as a director of the Central Building Research Institute in India." . . . **Young Kun Park**, SM '74, of Wyckoff, N.J., writes: "After 21 years of employment with Woodward-Clyde Consultants, I recently established a geotechnical engineering consulting firm. I provide engineering services to architect/engineering firms in the New York metropolitan area as well as to clients in Korea and Malaysia. Running my own firm is quite exciting and challenging." . . . **Brian**

Baker, SM '92 (I, XVII), was promoted from captain to major in the New England division of the U.S. Army Corps of Engineers. Baker joined the division in July 1993 following a tour as project engineer with the Cairo Central Resident Office in Egypt. Baker first enlisted in the Army Reserves and was later commissioned a second lieutenant in the Rhode Island Army National Guard. He later received his regular commission upon graduating from the University of Rhode Island with a BS. Among his military decorations are the Meritorious Service Medal, the Army Commendation Medal with oak leaf cluster, the Army Achievement Medal with oak leaf cluster, the National Defense Service Medal, the Army Service Ribbon, and the Overseas Service Ribbon. He also holds the Army Engineer Association's deFleury Medal (bronze order). Baker is a registered professional engineer and a member of the Society of American Military Engineers, the American Society of Civil Engineers, and the Army Engineer Association. He and his wife, Kelli, are the parents of eight-year-old twin daughters, Erin and Lauren, and newborn son, Brendan. The family resides in Needham, Mass.

Howard E. Webster, SM '37, died January 10, 1995, in Troy, N.Y., at age 86. He was a 1933 graduate of the U.S. Military Academy. He retired as deputy for the Civil Engineering 4601st Support Wing Air Defense Command at Stewart Air Force Base in Newburgh, N.Y., after 31 years of service. He also was a mathematics teacher for the New York Military Academy in Cornwall-on-Hudson for 10 years.

Nathaniel Macon Martin, SM '38, U.S. Army (Ret.), of Williamsburg, Va., died August 15, 1995, in Lewes, Del., of complications from a stroke. A 1935 graduate of West Point, he served in the U.S. Army Corps of Engineers from 1935 until retiring in 1957. During World War II, he served as chief of staff in the Persian Gulf Command and designed the crest worn by the command. Martin was also in charge of building three air fields in Russia so that the 8th Air Force could implement the Triangle Bombing Route, which doubled the bombing capacity. At the close of his military career, Martin was on the faculty of the Army War College in Pennsylvania.

Following his military career, he worked as director of facilities planning and development for IBM from 1957 to 1965. He was involved in the design and development of the 1964-65 World's Fair IBM Building. From 1965 to 1969, he worked for the Olin Matheson Corp./Squibb Group in facilities planning and building design. From 1969 to 1971, he was a VP for ITT, Inc., and worked as head director of design and development for Sheraton Hotels. In 1971, he formed Industrial Design and Development Corp. During this time he was involved in design and development of facilities at home and abroad, such as Bethany Pines in Bethany Beach and hospitals in the Middle East.

Alumni may send information for Course News to mitalum@mitvmc.mit.edu

MECHANICAL ENGINEERING

From Berkeley, Calif., **Boris Rubinsky**, PhD '81, writes: "In 1995, I received the Best Paper Award from the Japan Society of Mechanical Engineering, and a certificate of merit from the Radiological Society of North America. I was also elected president of the American College of Cryosurgery." . . . **Anthony C. Lunn**, ScD '72, writes: "I am the director of Stent Therapeutics Research at Johnson & Johnson Interventional Systems in Warren, N.J. Stents are miniature mesh-like tubes that hold open narrowed or blocked arteries. In the last few years, they have revolutionized the field of coronary angioplasty, and have become the standard of therapy. It's been (and still is) exciting to be involved with the development of a whole new technology." . . . **Kate Gasser**, SM '91, from Hopkinton, Mass., reports: "I became a certified professional engineer in 1995." . . . **Bertram S. Noyes, Jr.**, SM '67, ME '69, reports: "I am working as a senior engineer at GE Aircraft Engines in Lynn, Mass., on mechanical components design for the F-18 E/F fighter." . . . **Frank Heymann**, SM '53, of Winter Springs, Fla., reports: "I am in my sixth year of retirement from Westinghouse's steam turbine engineering division. I am still moderately active in

DEGREE CODES

AE	Aeronautical Engineer
BE	Building Engineer
CE	Civil Engineer
CHE	Chemical Engineer
CSE	Computer Science Engineer
DPH	Doctor of Public Health
EAA	Aeronautical & Astronautical Engineer
EE	Electrical Engineer
EGD	Doctor of Engineering

ENE	Environmental Engineer
MAA	Master in Architecture Advanced Studies
MAE	Materials Engineer
MAR	Master in Architecture
MCP	Master in City Planning
ME	Mechanical Engineer
MET	Meteorologist
MIE	Mineral Engineer
MME	Marine Mechanical Engineer
MNG	Master in Engineering

MPH	Master in Public Health
MTE	Metallurgical Engineer
NA	Naval Architect
NE	Naval Engineer
NUE	Nuclear Engineer
OCE	Ocean Engineer
PhD	Doctor in Philosophy
ScD	Doctor of Science
SE	Sanitary Engineer
SM	Master of Science



Melvin Chang, ScD '51 (III), and his wife, Diana, of Ponte Vedra Beach, Fla., traveled to Alaska with the MIT Alumnae Travel Program in August 1995. They were accompanied by their grandchildren, Benjamin, 11, and Sarah, 8.

ASTM committees on wear and erosion, and on environmental acoustics. I also volunteer for AARP as a tax aide and a "55 Alive" instructor. I recently joined the Jewish Genealogical Society of Greater Orlando. . . . Ron Sticinski, SM '83, OCE '83 (XIII), of Vienna, Va. writes: "I am an associate at Booz Allen & Hamilton. I support numerous government organizations such as the Naval Sea Systems Command, the Naval Surface Warfare Centers (Dahlgren, Indian Head, and Carderock), and the AEGIS Shipbuilding Program Manager. I am also the engineer and program manager for the development and acquisition of naval displays and workstations. Cookie and I have two boys, Alex and Nicholas (ages 5 and 3). I am a member of the U.S. Naval Reserve. I was promoted to commander and was assigned to the Naval Weapons Station in Earle, N.J." . . . David P. Greeneisen, SM '68 (II, XIII), was named VP for engineering at Standard Products Co. He most recently served as VP for product engineering at Masland Industries. Greeneisen has an MBA from St. John's University of New York. He received a BS in engineering from the U.S. Naval Academy.



Arthur Bergles

Arthur E. Bergles, '57, SM '58, PhD '62, of Troy, N.Y., was selected to receive the 1995 Max Jakob Award from the American Institute of Chemical Engineers and the American Society of Mechanical Engineers, in recognition of eminent achievement and distinguished service in the

field of heat transfer. This is the highest international award in the field. He is the Clark and Crossan Professor of Engineering at Rensselaer Polytechnic Institute. He is a Fellow of AAAS, ASEE, ASHRAE, and ASME, and a member of NAE. He was the president of ASME and dean of engineering at Rensselaer.

Arthur M. Spiro, SM '47, recently retired as the chairman and CEO of Carleton Woolen Mills. During his retirement, he will operate his own consulting company, A.M.S.-Tex Enterprises Inc., and continue to have involvement in Tex Tech Industries, an industrial fabric company. He will also write a novel and occasionally teach at the Arthur M. Spiro Center for Entrepreneurial Leadership at Clemson University College of Commerce and Industry. Allied Textile Companies PLC of the U.K., which acquired Carleton in 1994 from Spiro, dedicated its ultramodern woolen mill in Winthrop, Maine, as the Arthur M. Spiro Plant. During Spiro's textile career, which includes experience as an engineer, technician, merchant, executive, and entrepreneur in the textile and apparel industries, he served as president of the Textile Distributors Association and the American Association for Textile Technology.

Thomas David Higgins, SM '56, a retired computer specialist for Union Carbide Corp., died March 10, 1995, at St. Francis Hospital in Charleston, W. Va., at the age of 66. Higgins graduated from Lowell Technological Institute in 1951. After moving to Charleston in 1956, he became a West Virginia official in the 1964 presidential campaign of Barry Goldwater. A leader in the South Carolina Republican Club and the Kanawha County Young Republicans, he won his party's 1972 nomination for Congress but lost to the Democratic incumbent. Higgins also wrote a column for the *Charleston Gazette*.

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MATERIALS SCIENCE AND ENGINEERING

Peter S. Whitney, PhD '86, works on the development and manufacture of optoelectronic devices for fiber-optic communications at Lasertron, Inc., which he joined in 1988. He is now assistant director of engineering responsible for component development and packaging technologies. He recently moved to Lexington, Mass., with his wife, Mindi, and their two children. . . . Varadachan Sadagopan, SM '60, MTE '61, ScD '65, of Scarborough, N.Y., writes: "I started my own company, Networked Multimedia Services, in July 1995. After 26 years of service with the IBM research division, I am delighted to start a new career. I am producing CD-ROMs for educational and cultural applications. I am consulting with Pace University in New York to apply the power of multimedia technologies for computer-based training applications. I am having a grand time in my post-retirement career." . . . Svante Prochazka, SM '68, from Ballston Lake, N.Y., writes "I retired in 1994 from GE R&D after 23 years as a staff scientist with the ceramic laboratory. I continue to consult in structural ceramics at GE and elsewhere. I enjoy sharing my experience with my young colleagues as an informal advisor, occasional lecturer, and reviewer. I continue to

work on papers reviewing the sintering of covalent materials, my longtime favorite field." . . . Ernst B. Weglein, SM '58, MTE '59, of Brookline, Mass., writes: "I am practicing law and enjoying it. How about a reunion of John Wolff's graduate students sometime soon?" . . . Wego Wang, SM '78, ScD '82, accepted a position with the Federal Aviation Administration. He was previously employed at the U.S. Army Research Laboratory in Adelphi, Md. . . . Hyuck Mo Lee, PhD '89, is an associate professor at Korea Advanced Institute of Science and Technology in Taejeon. . . . Dan Blickwede, ScD '48, of Green Valley, Ariz., writes: "Although I am no longer involved in technical matters, I maintain an interest in the fields I once operated in. Since taking up residence in this region about five years ago, much of my time has been involved in searching for old abandoned mines in the nearby mountains, and placing signs that warn people to stay out. There are literally thousands of these holes in the ground just within a 50-mile radius of here, most of them dug about 100 years ago. Some were the work of the Spaniards in the 18th century. A group of us are doing this as volunteers for the U.S. Forest Service. It's fun, good exercise, very scenic, and I'm learning a bit of geology." . . . Gerbrand Ceder, the Alcoa Associate Professor in MIT's Department of Materials Science and Engineering, was named the 1996 recipient of the Robert Lansing Hardy Gold Medal by the Minerals, Metals, and Materials Society. This award, which was first offered in 1956, is given to the most promising young metallurgist under the age of 30. The award is named for an MIT student who died unexpectedly during his studies at MIT. Ceder's research interests include: computational materials science, thermodynamics and phase transitions, phase diagram computations, lattice dynamics, conductivity in oxides and electronic ceramics. He holds a PhD in materials science from UC/Berkeley.

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ARCHITECTURE

Mayer Abbo, MAR '92, of Boca Raton, Fla., reports: "Shortly after graduation I went to work in Caracas, Venezuela, where I was part of a project team developing some ideas for a mixed-use development in the heart of the city. I am now settled in Boca Raton working at a small architectural firm that mostly handles residential work. I am planning to take the ARE this coming summer and am also making plans to start my own design-build firm."

Thomas J. Nally, MAR '77, MCP '77, reports: "I was appointed by the Brookline, Mass., Board of Selectmen to co-chair the recently established economic development advisory board. Our role is to promote appropriate development in Brookline that enhances the town's environment and supports existing commercial areas. Amy Schectman, MCP '82, is the town's new economic development officer and works closely with our board." . . . Karen M. Bonner, MAR '81, from Chester, N.J., writes: "I'm again developing my own graphic design/art business, MARI Graphics, and I'm also working for L.S. Transit System,

Inc., in Bloomfield, N.J., as a senior architect. I've been drawing and painting watercolors to exhibit in local shows. It's great fun! Joe Bonner, SM '81 (I), and I are raising two boys, Michael (8 1/2) and Christopher (5), and enjoying ourselves together."

In July 1995, **Dominic Adducci**, SM '86, was named a managing director of Stein & Co., an international, full-service real estate firm based in Chicago. . . . **Carolyn Swartz**, SM '80, writes: "I live in New York City and am president/creative director of B-Pictures, a company that makes innovative corporate training and marketing videos—most recently for Chase Manhattan and AT&T. My son, Julian, is three." . . . **James Richardson**, MCP '81, MAR '81, reports: "After four years as director of the community and regional planning program at University of New Mexico's School of Architecture and Planning, I am on sabbatical as a visiting associate professor of urban design and development at MIT's Department of Urban Studies and Planning. I am also completing a major study with **Andy Reamer**, MCP '81, PhD '87, on technology transfer and the economic impact of Los Alamos National Laboratory on northern New Mexico. I was awarded a fellowship from the Asian Cultural Council to be a scholar in residence at the Chinese University of Hong Kong's Department of Architecture in the spring of 1996."



Martha Welborne

Skidmore, Owings & Merrill appointed **Martha Lampkin Welborne**, MAR '81, MCP '81, as the managing director of the Los Angeles office. She is responsible for the overall management of the office's business operations in addition to spearheading planning and urban design projects. Her project experience

ranges from individual building design to large-scale planning. Besides working with private sector clients, she has extensive experience with governmental agencies as well as medical and educational institutions. Welborne has served as the national chair of the regional and urban design committee of the American Institute of Architects. In 1993, she was elected into the American Institute of Architects' College of Fellows. In August 1995, Welborne was appointed to the policy board of the American Institute for Architectural Research. . . . Boston architect **William L. Rawn**, MAR '79, became the 14th recipient of the Louis Sullivan Award for Architecture. The award, with its \$25,000 prize, is sponsored by the International Union of Bricklayers and Allied Craftsmen (BAC) to spotlight exceptional architectural work and environmental improvements that contain masonry as a major element. Since Rawn founded William Rawn Associates, Architects, Inc., 12 years ago, it has become a leader in architecture and urban design, known for distinguished projects from affordable housing to concert halls. In 1995, Rawn received an American Institute of Architects Honor Award for the Seiji Ozawa Hall at Tanglewood. The firm designed two award-winning moderate- and low-income housing projects in Boston, sponsored

by a non-profit housing organization in which BAC's Local 3 Massachusetts had a leading role. The 50-unit Charlestown Navy Yard project reclaimed waterfront property to create affordable brick townhouses. The three-part buildings of concrete block and brick exteriors are linked by masonry details such as a horizontal brick-granite checkerboard band. Another project, a 165-unit complex of brick rowhouses in Boston's Mission Hill section known as the Back of the Hill Rowhouses, created six different street front patterns, all with brick exteriors and precast concrete floor planks. Recognized by numerous critics of architecture and urban planning, Rawn's projects are also entries for the National Excellence Awards, to be presented at the United Nation's Habitat II City Summit in Istanbul, Turkey, in June 1996. Rawn has a BS from Yale University in political science and a JD from Harvard Law School.

Kristen Ellen Finnegan, a doctoral student, died unexpectedly on June 25, 1995. Finnegan had received BS and MA degrees in the history of architecture from Cornell University and a professional degree in architecture from Harvard University. She came to MIT in 1992 to work on a doctorate focusing on the integration of art and industry in the early modern period in Germany. She had planned to conduct research in Germany last year. Since coming to the Institute, Finnegan had been a graduate fellow in the practicum of engineering writing in the Writing Program.

John Lindstrom, MAR '41, former chairman and the last surviving named partner of the Setter, Leach & Lindstrom architectural and engineering firm in Minneapolis, died March 14, 1995, in Scottsdale, Ariz. His best-known designs are the Prudential Insurance Building in Golden Valley, Ariz., and the library at Carleton College in Northfield, Minn., which was his favorite work. His biggest client was Northwestern Bell Telephone Co. (now US West Communications), and he was involved in almost every telephone building that company built in Minnesota. Colleagues at Setter, Leach & Lindstrom said Lindstrom's most enduring legacy was his unwavering commitment to customer service. He was known to dash across town at a moment's notice to meet with a client, even when the request came at quitting time on Friday. He also was a distinguished watercolor painter and was a member of the Northstar, Midwest, and Arizona Watercolor societies. Lindstrom was born and raised in Minneapolis. He graduated from the University of Minnesota with a degree in architecture. He also studied at Princeton University. During World War II, he served on a team of aerial observers in the South Pacific. His mission was to calculate which size of bomb was needed to destroy certain targets. In 1945, Lindstrom joined Magney, Tusler & Setter, which later became Setter, Leach & Lindstrom. He became a partner in 1952 and went on to serve as treasurer, president, and chairman.

The Association of Alumni and Alumnae was notified that **Philip Edward Keene**, SM '32, of Tacoma, Wash., died on August 6, 1995, and **James Shand Craig**, MAR '35, of Peterborough, Ont., died on July 21, 1995. Both were retired. No further information was provided.

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FOOD SHOPPING on the Internet has become a reality, thanks to Alex Sherstinsky, SM '89, ScD '94 (upper left), and Chon Vo, '82 (lower right). They founded the Smart Food Co-Op, which buys grocery items wholesale and delivers them at retail prices. At their shopping site on the World Wide Web, <<http://thinkpix.com/sfcl>>, shoppers enter the main store and click on needed items that are placed in a computerized basket, which keeps a running tally of the bill. Orders are submitted to wholesalers who deliver the goods to the firm's Cambridge office the next day. The items are then packed in vans for delivery. MIT students and Cantabrigians were the first to enjoy shopping online at the Smart Food Co-Op when the service opened in 1990. Since then, the service has expanded to several communities west of Boston, with sales totaling \$25,000 weekly.

V CHEMISTRY

From Tallahassee, Fla., Julio Arrecis, PhD '92, writes: "I was promoted to chemist administrator at the Florida Department of Environmental Protection. I manage a group of four scientists who are measuring sub-part, per-trillion-level-mercury species in the Everglades." . . . Lisa Wang, PhD '93, writes: "In June 1995, I relocated to the San Francisco Bay area to start a research position in the medicinal chemistry group at Shaman Pharmaceuticals, Inc." . . . John Piper, PhD '60, of Simpsonville, S.C., writes: "In the spring of 1996, my wife and I will move to our new mountain retirement home in northern Greenville County. My retirement from KEMET as VP for technology comes after 35 years in the electronics industry. I look forward to an active retirement working in the public schools, read-

ing, traveling, and volunteering in the community." . . . Jacob A. Marinsky, PhD '49, writes: "I am a professor emeritus of chemistry at the State University of New York at Buffalo. I edited *Ion Exchange and Solvent Extraction-Vol. 12*, which was published in March 1995. I also had three papers published last year." . . . The Association of Biomolecular Resource Facilities has recognized Klaus Biemann, professor of chemistry, for his pioneering work in the application of mass spectrometry to the biological sciences at MIT for nearly 40 years. He received its Beckman Award for seminal contributions to the field at its meeting in July 1995. Biemann's laboratory developed and refined mass spectrometric methods for obtaining detailed structural information on biomolecules as well as technology to improve the sensitivity of computer algorithms for analyzing data. . . . John J. MacDonnell, PhD '67, is one of seven Jesuits among the 45 faculty members being honored for 25 or more years service at Holy Cross College in Worcester, Mass. "I fell madly in love with the place from

the start," said McGrath, who returned to teach at Holy Cross after earning a PhD in organic chemistry at the Institute. "I left at 17 and came back at 32," MacDonnell said. "When I left here, I very much hoped I'd come back some day."

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V

ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Alan T. Sherman, SM '81, PhD '87, was promoted to associate professor of computer science with tenure at the University of Maryland. Sherman enjoys tennis, aikido, music, and chess. He and his wife, Tomoko Shimakawa, live in Columbia, Md. . . . Charles D. Trawick, SM '80, writes: "After more than 13 years designing microwave instrumentation for Scientific-Atlanta, I transferred to the division that makes interactive digital converter boxes for cable TV. It's a whole different planet!" . . . Nomi Harris, SM '89, reports: "I am working at Lawrence Berkeley National Labs writing software for the Human Genome Project." . . . Miguel Velez-Reyes, SM '88, EE '88, PhD '92, writes: "I was promoted to associate professor at the Department of Electrical and Computer Engineering at the University of Puerto Rico." . . . From Rocky River, Ohio, Frank P. Zaffarano, SM '47, writes: "In honor of the radiation lab work that I conducted in Europe from 1943 to 1946, I was awarded the Medal of Freedom by the Senior Citizen WWII Program. I was surprised by a visit from Charles Swartwout, SM '47, and his wife, Gretchen, of Sedona, Ariz. I retired in 1987 from Gould, Inc., New Development Group. I'm busy with my Amiga and Macintosh computers." . . . Roy L. Morris, SM '78, EE '78, writes: "I am now the director of public policy at the Frontier Corp. I received the executive MBA from the Wharton School of Management in May 1995." . . . Wilbur Pritchard, '52, of Bethesda, Md., writes: "I am still the president of my own consulting engineering firm, W.L. Pritchard & Co., Inc. I was recently elected to the National Academy of Engineering." . . . Kenneth Exworthy, SM '59, of Marinette, Wis., writes: "I am working on a measurements text for associate's-level programs. The book is intended for classroom use and will contain the elements needed by a classroom instructor. My 'daytime job' is teaching electronics and instrumentation at Northeast Wisconsin Technical College." . . . Eni G. Njoku, SM '74, PhD '76, of Pasadena, Calif., was elected a Fellow of the Institute of Electrical and Electronics Engineers in January 1995 for "contributions to spaceborne passive microwave remote sensing of the earth." . . . Rich Staats, PhD '94, of McLean, Va., writes: "I am currently working at the Logistics Management Institute as an analyst and advisor to senior members of the U.S. federal government on issues relating to logistics execution and modeling. Recent projects include logistics over-the-shore, analysis of advanced traffic management systems, and strategic mobility modeling. I recently wrote a paper on intelligent agents as transportation coordinators, which was presented at IJCAI '95 and will appear in a Springer-Verlag book in early

1996. Interested parties can obtain additional information from my homepage at <<http://198.3.128.73/staats.html>>." . . . From Huntington, N.Y., Stanley I. Kramer, SM '46, writes: "In my retirement, I am playing a lot of golf and struggling with a newly acquired computer." . . . Michael Loui, SM '77, PhD '80, writes: "At the University of Illinois/Urbana-Champaign, where I am a professor of electrical and computer engineering, I won the university's Luckman Award for Distinguished Undergraduate Teaching."

Edward J. McCluskey, '52, SM '53, ScD '56, a professor of electrical engineering and computer science at Stanford University, received the IEEE Emanuel R. Piore Award "for pioneering and fundamental contributions to design automation and fault tolerant computing." The award is presented for outstanding achievement in the field of information processing. McCluskey received the AB in mathematics and physics from Bowdoin College. The Institut National Polytechnique de Grenoble awarded him the doctor honoris causa degree in 1994. He worked on electronic switching systems at the Bell Telephone Laboratories from 1955 to 1959. In 1959, he moved to Princeton University, where he is a director of the University Computer Center. In 1966, he came to Stanford University, where he is a professor of electrical engineering and computer science, as well as the director of the Center for Reliable Computing. He founded the Stanford Digital Systems Laboratory (now the Computer Systems Laboratory) in 1969 and the Stanford Computer Engineering Program (now the Computer Science MS Degree Program) in 1970. The Stanford Computer Forum was started by McCluskey and two colleagues in 1970 and he was its director until 1978. As a doctoral student at MIT, McCluskey developed the first algorithm for designing combinational circuits—the Quine-McCluskey logic minimization procedure. At Bell Labs and Princeton, he developed the modern theory of transients (hazards) in logic networks and formulated the concept of operating modes of sequential circuits. His research at Stanford focuses on logic testing, synthesis, design for testability, and fault-tolerant computing. He and his students at the Center for Reliable Computing worked out many key ideas for fault equivalence, probabilistic modeling of logic networks, pseudo-exhaustive testing, and watchdog processors. He collaborated with Signetics researchers in developing one of the first practical multi-valued logic implementations and then worked out a design technique for such circuitry. McCluskey served as the first president of the IEEE Computer Society. In 1984, he received the IEEE Centennial Medal and the IEEE Computer Society Technical Achievement Award in Testing. In 1990, he received the EURO ASIC 90 Prize for outstanding fundamental contribution to logic synthesis. The IEEE Computer Society honored him with the 1991 Taylor L. Booth Education Award. He is a Fellow of the IEEE, AAAS, and the ACM. He has published several books and book chapters as well as hundreds of papers. His most recent book is *Logic Design Principles with Emphasis on Testable Semicustom Circuits* (Prentice-Hall, 1986).

Rear Admiral Scott L. Sears, SM '70, EE '71, USN (Ret.), joined AT&T Advanced

CourseNews

Technology Systems (ATS) as director of the integrated undersea surveillance systems (IUSS) strategic business unit. Sears leads the IUSS team in designing, building, and installing advanced fixed and mobile undersea surveillance systems for the U.S. Navy and for other navies and governments worldwide. "With 29 years of experience in engineering and technology management, Scott is exceptionally well qualified for this critical leadership position," said AT&T ATS President Charles E. McQueary. "In addition, his extensive international experience will be invaluable to us in expanding our global marketing efforts." Since 1966, Sears has held numerous leadership and technical positions with the U.S. Navy. Most recently, he was commander of the Naval Undersea Warfare Center in Newport, R.I. Leading a 7,000-member organization, he was responsible for research, development, and engineering of U.S. undersea warfare systems. He also spent more than three years as the program manager of the Naval Sea Systems Command in Washington, D.C. There, he was responsible for development of the integrated combat and acoustic systems of the new Seawolf attack submarine. Sears also formerly headed the Navy's Tactical Weapons Branch and commanded the USS *Albuquerque*, a nuclear-powered attack submarine with a crew of 130. He also held subordinate commands on other nuclear- and diesel-powered submarines. He is a graduate of the U.S. Naval Academy and Duke University's Fugua School of Business Advanced Management Program.

Elizabeth Bradley, '83, SM '86, PhD '92, an assistant professor in the computer science department at the University of Colorado/Boulder, is one of 20 faculty members nationwide named winner of a 1995 Packard Fellowship, a prestigious five-year award worth \$500,000 to each recipient's research program. Bradley, 34, has focused her research efforts on creating new computer programs incorporating artificial intelligence to help solve complex engineering design problems. Bradley, who is probing the practical uses of chaos theory in her research, combines aspects of applied mathematics, computer science, and electrical engineering. Bradley said the majority of the Packard Fellowship award will be used to fund undergraduate and graduate student tuition and stipends for members of her research team.

In June 1995, Brian Hinman, SM '84, the founder and CEO of Polycom Inc., presented the City of San Jose with a special edition SoundStation conference phone in recognition of the city's commitment to economic development and international export of Bay Area products. According to a Polycom press release, SoundStation has become the world's best-selling conference phone since its introduction in September 1992 and is used in more conference rooms by more companies than all other competitive products combined. With 50,000 SoundStations sold to date, Polycom has set a new industry standard for volume shipments of teleconferencing products.



Harold Spuhler

Harold Spuhler, SM '50, of Baytown, Tex., died on March 24, 1995. Spuhler was born in Tucumcari, N.M. He received a BS in electrical engineering from Texas Tech and a PhD in electrical engineering from the University of Illinois. He served as professor and department head of electrical engineering at Texas

Tech. Thereafter, he went to work for the National Science Foundation in Washington D.C. as program director and during his tenure there was honored by having his name placed in *Who's Who in America*. He retired from the National Science Foundation in 1979. He acted as a consultant to the Saudi Arabian Government on a solar energy program.

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VI-A INTERNSHIP PROGRAM

Career fairs on campus have become ever more popular with potential employers and students over the past few years. In the fall, the Society of Women Engineers (SWE) holds its annual fair and, each February, another is held by Tau Beta Pi, the engineering honorary society.

It is interesting how many of our VI-A participating companies also participate in MIT career fairs. Noted in this Fall's SWE Listing are: Bellcore, Bolt Beranek & Newman, Inc. (BBN), Digital Equipment Corp. (DEC), Draper Laboratory, IBM Corp., Intel Corp., Lincoln Laboratory, Qualcomm, Inc., SatCon Technology, Schlumberger, and Texas Instruments (TI).

Both MIT's Eta Kappa Nu chapter (EECS) and the Tau Beta Pi chapter at the School of Engineering prepare résumé books which are eagerly sought by prospective employers and have become moneymakers for the chapters. As an advisor to both associations, I have watched these activities grow in enthusiasm and usefulness over the past years.

Speaking of recruiting, VI-A Director, Professor **Markus Zahn**, '67, SM '68, EE '69, ScD '70, tells me preparations are under way for VI-A's upcoming selection season starting with the traditional VI-A orientation lecture on February 7. Our brochures and World Wide Web pages (<<http://www-ecsc.mit.edu/via/index.html>> in case you're interested) have been updated. The target date for selecting the new class is April 8.

Many high honors have recently come to Course VI Faculty. The National Medal of Science was presented to Institute Professor **Hermann A. Haus**, ScD '54, by President Clinton at a Washington, D.C., ceremony. Professor **Arthur B. Baggeroer**, SM '65, EE '65, ScD '68, and Professor **William F. Schreiber** were elected to the National Academy of Engineers. Also honored by a special symposium in Tucson, Ariz., was Professor Emeritus **Gordon S. Brown**, '31, SM '34, ScD '38, for his application of 'system dynamics,' which was developed by Professor **J.W. Forrester**, SM '45, to Tucson's K-12 schools.

Many of you may know that in June the Lowell Institute School (LIS) will move from MIT, where it was founded in 1903, to Northeastern University's School of Engineering Technology. Classes there will begin in the fall. It is an honor that one of our graduates, **Bruce D. Wedlock**, '56, SM '58, ScD '62, has successfully served as LIS director for the past 23 years!

The VI-A Office learned that **George Jeronakoff**, '49, SM '50, of Loudonville, N.Y., a veteran of WWII's Battle of the Bulge, died on April 13, 1995. After completing his VI-A work with the Bell System, he then joined the General Electric Co. in Schenectady, N.Y., where he worked for 40 years.

Recent visitors to the VI-A Office have included: **Geoffrey J. Bunza**, '74, SM '77, EE '78, PhD '81, the VP for engineering and operations at Eagle Design Automation in Beaverton, Ore., and **Neil M. Haller**, '58, SM '59, EE '61, who represented Bellcore at the SWE Career Fair.—**John A. Tucker**, director (emeritus) and lecturer, VI-A Program, MIT, 77 Massachusetts Ave., Rm 38-473, Cambridge, MA 02139-4307; e-mail: <jat@fenchurch.mit.edu>

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VII BIOLOGY

Rashid Shaikh, PhD '78, has been appointed the director of science and technology meetings at the New York Academy of Sciences. Shaikh, a biologist, was previously executive director of the Health Effects Institute—

Asbestos Research, a Cambridge-based non-profit organization that helped to establish in 1989 to investigate health risks from asbestos exposure in buildings. **Rodney Nichols**, the CEO of the New York Academy of Sciences, cited Shaikh's combined research and public policy experience as key qualifications in



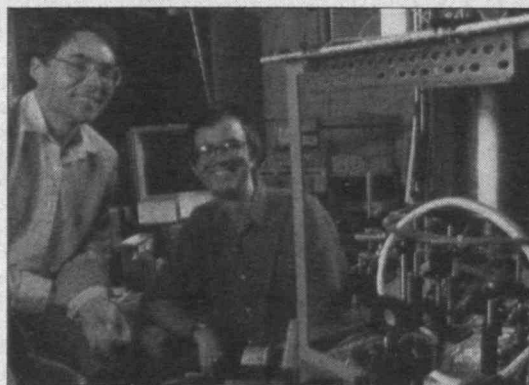
Rashid Shaikh

assisting to diversify the academy's conferences and scientific programs, and to move the academy forward in communicating the content and impacts of research to the public. He earned BS and MS degrees in chemistry in India and was a post-doctoral fellow at Harvard Medical School.

In 1980, he joined the Harvard School of Public Health, where he was appointed director of the school's programs in environmental health and public policy in 1982. Founded in 1817, the New York Academy of Sciences, an independent, non-profit organization with 46,000 members in 160 countries, is committed to serving science and technology worldwide.

Jeremy Paul, PhD '86, reports: "For the last five years I have been living in Nyack, N.Y., just north of New York City. For the past three years, I have been at Cadus Pharmaceutical Corp., a biotech company with 60 employees, in Tarrytown, N.Y. I am the project manager in charge of developing a screening system for diseases associated with defects in

On June 5, 1995, Eric Cornell, PhD '90 (left), and Carl Wieman, '73, physicists at JILA, a joint program of the National Institute of Standards and Technology and the University of Colorado, created a new state of matter that was predicted decades ago by



Albert Einstein and physicist Satyendra N. Bose. Cooling rubidium atoms below a threshold of 100 billionths of a degree above absolute zero caused the individual

atoms to condense into a "superatom" that behaved as a single entity. The researchers actually went well beyond the threshold: before photographing the superatom, Cornell and Wieman cooled the atoms to below 20 billionths of a degree above absolute zero, the lowest temperature ever achieved.

signal transduction. For two years, I worked at Progenics Pharmaceutical designing protein-based therapeutics aimed at disrupting the HIV-1 viral assembly. I am married to Anna Hammond, an artist, and we have two children, Isaac, 8, and Henri, 5." . . . Richard Schwartz, PhD '80, of Haslett, Mich., is an associate professor of microbiology at Michigan State University. . . . Janet Carminati, PhD '95, writes: "I am a post-doctoral fellow studying the yeast cytoskeleton in the lab of Tim Stearns, PhD '89, at Stanford University."

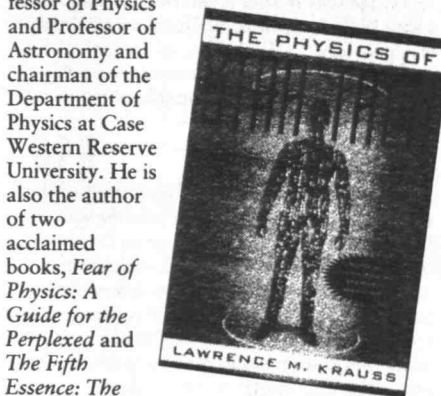
The Association of Alumni and Alumnae was notified that William Patton McHugh, MPH '48, of Danvers, Mass., died on May 26, 1995. He was retired. No further information was provided.

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VIII PHYSICS

Richard L. Fork, PhD '62, of Madison, Ala., was made a Fellow of the Optical Society of America at the annual OSA meeting, which was held in Portland, Ore., in September 1995. . . . Joshua Alspector, PhD '71, was named to an endowed chair in information technology at the University of Colorado/Colorado Springs. The position, which is the highest rung on the faculty ladder, is the third of three endowed chairs created five years ago at the university. Besides teaching, Alspector will devote time to the Colorado Institute for Technology Transfer and Implementation, an outreach program that acts as an information and technology broker between the university and the high-tech community. Since 1988, Alspector has been a director at Bellcore, the New Jersey-based telephone company research lab. He has been working on neural "learning" networks. Such technology could be used in telecommunications networks, for example, by enabling them to identify problems and automatically re-route calls so users' service isn't interrupted. Alspector earned a BS in physics from Rensselaer Polytechnic Institute in Troy, N.Y. . . . Jeffrey Norman, PhD '88, of Poughkeepsie, N.Y., writes: "In July, I received tenure at Vassar College in the Department of Physics and Astronomy." . . . Marion M. White, PhD '81, reports: "I am the linear accelerator manager of the Advanced Photon Source at Argonne National Lab." . . . Troy Soos, SM '89, is pursuing his interest in baseball in an entirely new career as a writer of baseball mysteries. His first one, *Murder at Fenway Park* (a player is bludgeoned to death), takes place in 1912, and was published by Kensington Publishing Corp. of New York City in 1994. That was followed by *Murder at Ebbets Field* (a team owner is poisoned). The third in the series, *Murder at Wrigley Field*, is due out this spring. According to *The Christian Science Monitor*, Kensington has extended Soos' contract to include three more titles, including *Hunting a Detroit Tiger*. . . . Last year, BasicBooks published *The Physics of Star Trek* by Lawrence M. Krauss, PhD '82. The inside flap offers the following insight: "With a foreword by the most renowned Trekker of all (and one-time *Next Generation* bit player), Stephen Hawking, and featuring a section on the top 10 physics bloopers and

blunders in *Star Trek* as selected by Nobel Prize-winning physicists and other dedicated Trekkers, this is a volume that will add a whole new dimension to your enjoyment of the series and to your appreciation of the universe we live in." Krauss is the Ambrose Swasey Professor of Physics and Professor of Astronomy and chairman of the Department of Physics at Case Western Reserve University. He is also the author of two acclaimed books, *Fear of Physics: A Guide for the Perplexed* and *The Fifth Essence: The Search for Dark Matter in the Universe*, and more than 120 scientific articles. He is the recipient of several international awards for his work, including the Presidential Investigator Award (1986). He lectures extensively to both lay and professional audiences and frequently appears on radio and television.



Charles Simon Naiman, PhD '61, of Brookline, Mass., died on July 26, 1995. For the past 13 years he had been working with his wife, Tzivi, in "incubating" high-tech startup companies in diverse fields such as cryogenics, medical lasers, optics, and tissue engineering. Prior to that he was a visiting scientist at the Center for Materials Science and Engineering at MIT and had held various positions at Sanders Associates of Nashua, N.H., including chief scientist in the defensive systems division and manager of laser systems. He was a member of Congregation Beth Pinchas in Brookline, where he was most proud of his role in establishing a program for college students. . . . Leonard Nelson Litzenberger, SM '69, PhD '71, of Andover, Mass., died on February 27, 1995. He was the principal research scientist for Textron in Everett, Mass., and held a patent in the field of laser isotope separation. He graduated from Lehigh University in 1967.

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X CHEMICAL ENGINEERING

Howard Klee, Jr., ScD '72, writes: "After serving as the director of regulatory affairs for the environment, health, and safety department of Amoco Corp. for several years, it was time for a change. In July 1995, I moved to Beijing and became the VP for refining at Amoco Orient Oil Co., Amoco's affiliate in China. As part of a new office here, my responsibilities include planning and developing Amoco's entry and growth into the petroleum products businesses in China. We are currently involved in preliminary studies on a joint venture refinery expansion project. We also started an LPG distribution venture in Shanghai earlier this year. China is a challenging and exciting place to be these days. During my second week here, I participated in a seminar on technology and sustainable development co-hosted by MIT and

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Tsinghua University, the premier technical institute here. It was a pleasure to see several friends, including Adel Sarofim, SM '57, ScD '62, from my earlier days on the East Coast. For anyone who may get to Beijing in the next few years, I can be reached by phone at 8610-501-2018 or fax at 8610-501-2024." . . . From London, Albert Humphrey, SM '49, reports: "I have been using and selling a team method for solving business and organizational problems. I buy shares in companies that use my method, which I call TAM (Team Action Management). Eighteen months ago, I bought shares in Wensum PLC, a maker of men's suits at \$32 per share. Today, each share sells for \$107. I recommend that MIT fund managers combine my TAM with their investment work, which would treble the fund value in 18 months. This would make funding of research at MIT easy." . . . Joseph B. Farrell, SM '47, from Cincinnati, writes: "I am semi-retired from the U.S. Environmental Protection Agency. I consult part-time in the area of sewage sludge processing and regulation. I seldom have contact with MIT engineers—why is a mystery to me. I enjoy encountering some of the names in *Technology Review* class and course notes, and the generous givers lists. I send my regards to them. The names I remember are getting shorter. Some are Joe Boscov, SM '47; Jim Finneran; Charlie Neas, ScD '47; John St. John; Lloyd Nicolai, SM '43, ScD '44; Bernie Chertow, ScD '48; Joe Collins; and Bob McBride, '42. I still enjoy the technical world, but the list of things I know nothing about keeps growing!" . . . Frank B. Sprow, '62, SM '63, was elected VP for environment and safety at Exxon. Previously, Sprow was VP for petroleum and synthetic fuels research at Exxon Research and Engineering Co. (ER&E) in Florham Park, N.J. He joined ER&E as a senior research chemical engineer in Baytown, Tex., in 1965. After several research and supervisory assignments, Sprow was named manager of the technical division at Exxon USA's Bayway Refinery in Linden, N.J., in 1975. He became operations manager at the Bayway Refinery in 1977. Sprow returned to ER&E in 1979 as general manager for petroleum research and development programs, based in Florham Park and became VP for synthetic fuels research in 1980. He was appointed VP for technology support at ER&E in Clinton, N.J., in 1982 and was named VP for corporate research in 1986. He was appointed VP for petroleum and synthetic fuels research at Exxon Research and Engineering Co. in 1993. He received a PhD in chemical engineering from UC/Berkeley. Sprow is chair of the Research and Development Council of New Jersey; chair of the Visiting Committee of the Princeton Materials Institute; and vice-chair of the Conference Board Council on Innovation. He is a member of the American Institute of Chemical Engineers, the Society of Automotive Engineers, and the Advisory Committee for the Department of Chemical Engineering at MIT. . . . Adel F. Sarofim, SM '57, ScD '62, the Lamont du Pont Professor of Chemical Engineering at MIT, received the 1995 Award for Innovation in Coal Conver-

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sion by the University of Pittsburgh. The award is based on outstanding contributions to coal science and engineering.

The Association of Alumni and Alumnae was notified that Robert Anthony Maglio, SM '54, of Lynnfield, Mass., died on September 1, 1995. He was the president of the Energy Balance Co. in Lynnfield. No further information was provided.

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X-A PRACTICE SCHOOL

As this is written, I'm fresh from the privilege of attending SCEP's 16th annual Information Conference—the occasion that brings to Cambridge representatives of sponsors of Practice School stations and fellowships. The conference's two purposes are to discuss the SCEP program and to meet (and perhaps recruit) MIT graduate students. There were lots of familiar faces and some interesting discussion.

Opening the meeting, whose participants he describes as a sort of "junior visiting committee," Professor Robert Brown, the head of the MIT Department of Chemical Engineering, reported that these are boom times for chemical engineering education, both nationwide and at MIT. There are lots of students partly because "chemical engineering is becoming the engineering field of widest application." Students now see chemical engineering as the preparation of choice for a wide variety of fields—chemical engineering, of course, but also biological engineering, medical research and practice, even finance and the management of technical industry. As a result, both the number and quality of applicants for graduate admission are rising. MIT is chosen by half of those to whom it offers admission. "We get the pick of the crop," said Brown.

But looking at the industry, Brown said, he and his faculty colleagues believe the greatest need now is not for PhDs and ScDs for which most graduate applicants come to MIT, but for well-prepared students at the master's level—one and a half or two years beyond an SB. This is the traditional forte of the Practice School, and he hopes SCEP's enrollment of fifth-year MIT students and master's candidates from outside the Institute can increase.

Professor T. Alan Hatton, SCEP director, told fellowship sponsors that their support is "absolutely vital." That will be especially true as SCEP increases its enrollment of master's students, because their time at MIT is so short they cannot qualify for research or teaching appointments. Industrial sponsors of SCEP fellowships include: Air Products, Amoco, Bayer, Exxon, W.R. Grace, Merck, Mobil, Procter & Gamble, Shell, and 3M. SCEP's annual budget comes from four sources, said Hatton: MIT (32 percent), endowment income (28 percent), companies hosting SCEP stations (29 percent), and fellowship sponsors (11 percent), and he hopes the last-named will grow as the master's enrollment grows.

Hatton announced winners of SCEP's three annual awards at the dinner. The Rosemary Wojtowicz ('82) Fellowship for personal qualities of kindness and concern for others went to Jorge Cantu, SM '95; last year's winner, Andre LeCesne, SM '94, is now with Shell Oil

Co. in Norco, La. Honored with the J. Edward Vivian ('39) Prize for outstanding leadership and management of project work was William Grieco, SM '95, now an MIT doctoral student. And the Jefferson W. Tester (PhD '71) Prize for enthusiasm and leadership went to Andrey Zarur, SM '95. The winners of last year's Vivian and Tester Prizes were, respectively, Charlene Suwanabhand, SM '94, and Markus Langner, SM '94, now an MIT doctoral student.

In addition to prospective, current, and recent SCEP students, 14 alumni attended the 1995 annual meeting: Thomas P. Griffin, '80, SM '81, PhD '89, of Molten Metal Technology; Charles Guthrie, SM '83, of Chevron; Robert Hanlon, SM '83, ScD '85, of Mobil; Joseph Harrington, '61 (XIV), SM '63 (XXII), ScD '66 (XXII), the assistant dean of development for the MIT School of Engineering; Kirk Limbach, PhD '89, of Rohm and Haas; Mark Marinan, '81, of Dow; Stephen Roll, SM '87, of the U.S. Army Natick RD&E Center; William Rousseau, SM '36, an MIT visiting senior lecturer; Jay Sobel, '61, SM '63, PhD '68, of Exxon; Kevin A. Sparks, PhD '91, of Molten Metal Technology; Jefferson Tester, PhD '71, director of the MIT Energy Laboratory; Anthony Turano, '54, SM '56, ScD '60, an MIT industrial liaison officer; Paul Webber, SM '90, PhD '90, of Air Products; and Colin Wolden, SM '92, PhD '95, the director of the Natick Station. Also present were Janet Griffiths, director of the West Point Station (Merck); Barry Johnston, director of the Midland Station (Dow and Dow-Corning); and Elizabeth Sluder, donor of a new fellowship honoring her late husband John C. Sluder, PhD '41.

News from recent graduates: After a year as a post-doc at MIT, Reza Mehrabi, SM '90, is working in Pensacola, Fla., for Monsanto making nylon fibers for carpeting. . . . Fred Armellini, SM '87, PhD '93, dropped by the SCEP office last fall while in Cambridge to visit Aspen Technology; he works as a process engineer at Arco Chemical, Philadelphia. . . . After many years of service, Charles A. Stokes, ScD '40, resigned as chair of the Florida Engineering Society's statewide energy committee; he's a well-known consulting engineer in the energy field, based in Naples, Fla. . . . To escape the summer heat of Houston, Harold A. Ricards, Jr., SM '41, and his wife, have for many years since he retired as Exxon marketing manager, journeyed to England and Scotland. But last year they tried a new strategy: summer on Bailey Island, Maine. And one day, for memory's sake, they drove north to Bangor where 55 years before he had signed in as a student with Roy Whitney, '35, SM '37, ScD '45, then director of the Bangor Station. In Ricards' words: "In South Brewer, we went over to the Eastern Manufacturing Co., which is still there after many changes in ownership and name. It fell on hard times, but in 1968 came back strong and is still flourishing. I introduced myself to management and started talking about MIT, the Practice School, Penobscot Chemical Fiber Co., and the pre-WWII days. Interestingly, present management seemed to know nothing about the Practice School nor that there had been any earlier relationship with MIT. I filled in some of this history verbally and have now done a write-up of the Bangor Station as I knew it 55 years ago. They gave me a paper, 'The Story of East-

ern Fine Paper,' that goes back to the original Brewer sawmill in 1771, which they now can revise to include the Practice School."

Professor Emeritus Alan S. Michaels, '44, SM '47, PhD '48, was honored at an MIT symposium late last fall. He was named to the MIT faculty in 1948, a year after his SCEP graduation, and left for the first time in 1966 when he began an industrial career heading companies based on his research. By 1982, he was back as an adjunct professor, and he's still a familiar figure on the campus since retiring in 1989. A highlight of the symposium was news of the founding of the Alan S. Michaels Distinguished Lectureship in Biomedical and Bioengineering, the fields of his latest research contributions.

Jerry A. McAfee, ScD '40, former chairman and CEO of Gulf Oil Corp., died on October 14, 1995 in Pittsburgh. He had been a SCEP enthusiast since graduation and was a leader of the group of influential alumni who in the 1980s convinced the MIT administration to maintain the Practice School and then formed the Friends of the Practice School to raise an \$8.3 million endowment for it. McAfee became a life member of the MIT Corporation in 1977, having previously served on the department's visiting committee. He spent his entire career in the oil industry, joining Gulf in 1945 and becoming its chairman in 1976.

Belatedly, we've learned of the death on March 3, 1992, of Robert D. Nutting, SM '30, ScD '33, in Yorklyn, Del. Before retirement, Nutting was for many years employed with the Pigment Division of the Du Pont Co. as a chemist, research supervisor, and finally patent manager. . . . Harold H. Spengler, SM '23, who had a 30-year career with General Electric, died last May 29 at his Cleveland, Ohio, home at the age of 98. At the time of his retirement in 1962, Spengler was manager of GE's Lamp Glass Technology Laboratory; he had joined GE in 1932 and became manager of GE's lamp division in Niles, Ohio, in 1945. Throughout his GE career, Spengler took special pride in training his employees—of whom 11 went on to be plant or section managers.

Send word of your activities to any of the following: Carol Phillips in the SCEP office, MIT, Room 66-309, MIT, Cambridge, MA 02139, <carol@pracschool.mit.edu>; Stephanie Grepo at *Technology Review* <grepo@mit.edu>; or the undersigned at *Technology Review*, address as below, or fax (617) 258-7886.—John Mattill, Room W59-200, MIT, Cambridge, MA 02139.

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XI URBAN STUDIES AND PLANNING

From San Jose, Calif., Peter Coe Verbica, SM '92, writes: "I am enrolled at Santa Clara University School of Law. I manage various commercial and residential properties on behalf of a private corporation and completed financing on two warehouse properties through CARR Capital as correspondent." . . .

Mary Akyas, MCP '81, writes: "I returned from Pasadena, Calif., where I was the VP for corporate communications at Montgomery Watson, a global environmental technology and consulting firm, to join New England Electric System companies as the director of corporate communications." . . . Yok-Shiu Lee, PhD '88, reports: "I'm now an assistant professor in the Department of Sociology at the Chinese University of Hong Kong. I teach sociology and modern society, and urban sociology." . . . James M. Symons, SM '55, ScD '57, of Houston, Tex., reports: "In May 1995, my new book, *Drinking Water: Refreshing Answers to All Your Questions*, was published by Texas A&M University Press. It is written in factual, but non-technical language, to explain this important topic to the general public. It retails for \$10.95 in bookstores or by calling 800-826-8911." . . . Wayne Moody, MCP '67, writes: "For the past six years, I have focused my work on issues of sustainable community design. The major effort has been managing the planning process for develop-

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ing an 820-acre new community called Covano in Tucson, Ariz. The goal is to develop a full community utilizing principles of sustainable design and to influence the future. The completed plan, planning process, and design guidelines were named "Best Project for 1992" by the Arizona Planning Association." . . . Christine Nelson, MCP '85, reports: "I am working on a PhD in history at the University of North Carolina/Chapel Hill and am examining the Americanization of immigrant girls and women." . . . Daniel A. Acosta, MCP '91, writes: "I am living in incredible San Francisco. Previously, I worked at a nonprofit economic development organization. Last fall, I opened the Acosta Agency, a private public-and economic-relations organization."

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XII EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

Richard W. Paulson, '66, of Reston, Va., was recognized by the U.S. Department of the Interior with the Distinguished Service Award for exceptional contributions in real-time hydrologic data collection systems development and management of the USGS National Water Summary program. He coordinated the development and installation of a flood warning system for Phoenix and Maricopa counties, Ariz., which was part of a bureau-wide program to develop the use of satellite telemetry for water-resources management. This technology is now widely used throughout the Department of the Interior. As a manager of the national Water Summary Program, Paulson managed the development of advanced publication techniques, including geographic information systems for preparation of illustrations and graphics. He was also responsible for implementing total quality management techniques that have led to reduced labor costs and improved published reports. Paulson, a native of New York, N.Y., began his career with the USGS in 1966. He holds a BS in geology from Hofstra University. He received the Meritorious Service Award from the Department of the Interior in 1984. He is a member of the International Water Resources Association. Now retired from the USGS, Paulson is a Senior Fellow at the World Environment Center, an international environmental organization in Washington, D.C. . . . Grant Buma, SM '70, from Salt Lake City, Utah, writes: "I am currently working with the BIA, USGS, U.S. Game and Fish, Arizona Game and Fish, California Game and Fish, and the Arizona Department of Water Resources to help save the Colorado River. I am employed by the Colorado River Indian Tribes and I have a private consulting practice. My consulting company is EHMI—Environmental Health Management, Inc. We are currently working on a soil and water remediation project for the Hilton Hotel."

From Cinnaminson, N.J., Hal Taylor, SM



In 1995, Navy Lieutenant Commander Mary Townsend-Manning, SM '87, NE '87, became the first woman designated as an engineering duty officer qualified in submarine systems. She is pictured with Admiral William Flanagan, commander-in-chief of the U.S. Atlantic Fleet.

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'62, writes: "With my wife, mother, other family members, friends, and neighbors, we are fighting to save from greedy developers the 89-acre wildlife refuge that is part of our 130-acre family farm. The latest plan is to build 118 townhouses on about 12 acres of land in the flood plains of the Delaware River adjoining our farm. Also the developers' land has 25 acres of "exceptional resource value" wetlands, and 10 acres of "intermediate resource value" wetlands. Many permits are needed for this major subdivision so there is great optimism that the project can be scaled back to something compatible with the site."



Robert White

with faculty and students in several departments and research centers. The Compton lectureship, established in 1957, honors the late Karl Taylor Compton, president of MIT from 1930 to 1948 and chairman of the MIT Corporation from 1948 to 1954. The purpose of the lectureship is to give the MIT community direct contact with the important ideas of our times as propounded by those who have contributed much to modern thought. In addition to the NAE presidency, White served as vice chairman of the National Research Council, the principal operating agency of the NAE and the NAS. From 1963 to 1977, White served the nation under five presidents, first as chief of the U.S. Weather Bureau and finally as the first administrator of the National Oceanic and Atmospheric Administration. He is credited with bringing about a revolution in the U.S. weather warning system with satellite and computer technology, helping to initiate new approaches to the balanced management of the country's coastal zones, and promoting the rebirth of American fisheries. As U.S. commissioner of the International Whaling Commission (1973-77), he led some of the first efforts to save whales. As the U.S. permanent representative to the World Meteorological Organization from 1963-78, he helped establish the World Weather Watch for continuous monitoring of the earth's atmosphere, the Global Weather Experiment to extend the time range of weather forecasts, and the World Climate Program to achieve an improved understanding of climate change. For three years immediately before his election as NAE president, he was president of University Corp. for Atmospheric Research, a consortium of 50 universities that operates the National Center for Atmospheric Research. He subsequently was president of the Joint Oceanographic Institution, a university consortium that manages the international deep-sea drilling program.

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XII

EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

Shashank V. Karve, OCE '81, of Singapore, writes: "I am the executive VP of MODEC and am on assignment in Singapore as manager of Amoco's Liuhua 11-1 FPSO Project. When installed in March 1996, this will be the first permanently moored production vessel in the South China Sea. The unit is in 1,050 ft. water depth." . . . John Mittleman, SM '70, of Lynn Haven, Fla., writes: "I was awarded a PhD in engineering mechanics from Iowa State University last summer. My research covered ultrasonic scattering from metal grain boundaries." . . . Harry B. Keller, NE '49, writes: "I was appointed professor emeritus of international economics at Troy State University." . . . Lieutenant Commander John Kusters, SM '92, OCE '92, reported aboard the Naval Pacific Meteorology and Oceanography Center in Pearl Harbor, Hawaii. . . . Richard D. Hepburn, SM '88, NE '88, writes: "I am the surface-combatant-type desk coordinator for the commander of naval surface forces with the U.S. Atlantic fleet. I published a paper, "Dual Use of Heavy Lift Ships for Maintenance and Transport of Mine Warfare Ships," in the September 1995 issue of *Naval Engineers Journal* . . . Another note from the 50th state came from Kevin Carpentier, SM '82, of Honolulu, who reports he is serving as executive officer of the high-endurance Coast Guard cutter RUSH. He recently returned from a Pacific ocean patrol that began with a joint law enforcement patrol with the Russian Frontier Guard and ended with the seizure of a stateless fishing vessel. The vessel was observed fishing with a 12-mile-long High Seas Drift Net, in violation of a UN General Assembly resolution. The seizure of the vessel, gear, and catch was the first ever by the Coast Guard. Carpentier is also active in the Hawaii section of the Society of Naval Architects and Marine Engineers, currently serving as the section's vice chairman. . . . James Q. Rice, SM '91, writes: "I am applying my skills in hydrodynamics at the Naval Undersea Warfare Center in Newport, R.I. My current projects are pushing me toward more of a managerial role with this organization, which prompted me to apply to MBA programs." . . . David Hermann, SM '91, writes: "I am at the State Department in the Office of Marine Conservation, Bureau of Oceans, Environmental and Scientific Affairs." . . . David S. Herbein, SM '87, NE '87, was promoted to captain. Herbein has served on the submarines USS Richard B. Russell, USS Canopus, and USS Andrew Jackson. In January 1995, he was transferred to the Naval Sea Systems Command Engineering Directorate headquarters in Washington, D.C.

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XIV

ECONOMICS

Sumner Rosen, PhD '59, writes: "My focus in recent years has been on the rehabilitation, redefinition, and restoration of full employment as the normative standard for the United

States. In 1995-96, I was a visiting fellow at the Cornell University School of Industrial and Labor Relations, a program to support the International Labor Organization (ILO) and the 15 International Trade Secretariats (ITs) in labor's struggle to protect and advance workers' rights and needs in the global economy. I also have a modest private practice in labor arbitration." . . . **Art Ashbrook**, PhD '47, writes: "I am continuing with my part-time work as economic guru on the CIA's annual compendium, *The World Factbook*." . . . **Thomas F. Malone**, SCD '46, the founding director of the Sigma Xi Center in Research Triangle Park, N.C., was a keynote speaker at the opening session in August 1995 of a western hemisphere workshop, "Global Change in the Americas." The workshop, which was held in Belem, Brazil, was sponsored by the Inter-American Institute for Global Change Research, an organization of sixteen nations in North and South America. Earlier that month, Malone presented a keynote lecture "The Scholarly Challenge of Stewardship," at the Triennial Convention and Symposium of Phi Kappa Phi in St. Louis, Mo., and gave a keynote paper, "Sustainable Development: Creating Agents of Change," at a conference sponsored by the American Association of Engineering Societies and the Engineering Foundation of New York. In July, Malone convened a Sigma Xi workshop in the Research Triangle Park area to address the potential of electronic networking to link these sixteen countries and their seven research themes on global change issues.

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XV MANAGEMENT

Charles R. Bland, SM '80, was named president of Owens-Corning's business operations in Latin America. Moving from Hong Kong, where he was president of the company's Asia/Pacific operations, Bland will be located at the company's Latin America headquarters in São Paulo, Brazil. Bland joined Owens-Corning in 1974 as a member of the control systems engineering department in Newark, Ohio. During the past 20 years, he has been manager of the mathematics and computer science group at the Science & Technology Center in Granville, Ohio; a marketing manager and supply and transportation manager for the Trumbull Asphalt division; corporate director of new business development; and VP for financial and business planning for composites. He was named as the company's first president for Asia/Pacific operations in 1993. Bland holds a BS in finance and accounting from the Ohio State University. Owens-Corning is the world leader in advance glass and composites materials. The \$3.4 billion company has 17,000 employees in more than 30 countries. . . . **Ray Stotemyer**, SM '88, joined NationsBanc Capital Markets, Inc., as a senior research analyst in the metals and aerospace/defense industries. Previously, he had been a senior high-yield analyst covering aerospace, steel, industrials, and building products for Bear Stearns & Co. Stotemyer was recently named to Institutional Investor's 1995 All-America Fixed Income Research

Team and was rated the top analyst in coverage of the aerospace/defense industry and a runner-up for his coverage in the metals/paper industry. He also earned a spot on the 1994 team as a runner-up for coverage of the industrials/manufacturing group. . . . **Jarold Boettcher**, SM '66, was inducted into the Kansas State University College of Engineering Hall of Fame. Boettcher is president of Boettcher Enterprises, Inc., in Beloit, Kans. He is a director of Guaranty State Bank and Trust, a trustee of the KSU Foundation and chair of their executive committee, and trustee of the Kansas Public Employees Retirement System. He has received the Distinguished Service Award from the Kansas State College of Engineering. He has served on several advisory boards, study committees, and boards for agriculture-related programs for the Kansas State Board of Agriculture and is a past president of the Kansas Fertilizer and Chemical Association. He holds a BS in nuclear engineering from Kansas State.

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SLOAN FELLOWS

Kofi Annan, SM '72, a life-long United Nations official, was named temporary envoy to the former Yugoslavia. The United States has welcomed Annan's appointment, with U.S. Ambassador to the UN Madeleine Albright quoted by a spokesman as having "an extremely high opinion" of him and believing "that his presence in former Yugoslavia will help ensure a smooth cooperation between the UN, United States and NATO." He began his career at the UN in 1962. . . . **Thomas E. Richards**, SM '91, has joined Ameritech as president of its network services unit. Richards heads the unit responsible for managing and operating Ameritech's five-state communications network and for providing related technical operations support. Previously, he was the VP for network operations at Bell Atlantic, where he was responsible for a multi-state networked organization that provided communications services to some 4.8 million customer lines in central and western Pennsylvania, the southern portion of Virginia, and all of West Virginia. Ameritech helps more than 13 million customers keep in touch. The company provides a wide array of local phone, data, and video services in Illinois, Indiana, Michigan, Ohio, and Wisconsin. . . . **Brian J. Kelly**, SM '73, of Naples, Fla., and Camden, Maine, was honored by Worcester Polytechnic Institute, where he received a BS in 1955, with the Robert H. Goddard Award for Outstanding Professional Achievement. He retired from a 40-year career with Bell Atlantic Corp. last year, stepping down from the post of VP for administration at Bell Atlantic Network Service. Kelly joined Bell of Pennsylvania as an electrical engineer in 1955 and was appointed VP and general manager of the Western Pennsylvania region in 1978. After the firm became part of Bell Atlantic Corp. in the mid-1980s, Kelly held a number of top administrative positions, including president and CEO for investment and development, and was later president and CEO for the highly profitable Information Products and Services Division. Shortly before he retired, he was responsible for the reorganization of Bell's business units and the development of new products and

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markets. His civic work includes the United Way, the Pittsburgh Symphony Society, and Hahnemann University. He served WPI as class president beginning at graduation and stepping down at his 25th Reunion, and was a member of the Electrical Engineering Advisory Committee and the Presidential Advisory Committee.

James Cheever Farley, SM '50, retired chair of Richmond Engineering Co. and a prominent civic leader, died of encephalitis on April 14, 1995. Farley joined Richmond Engineering Co. in 1937. In 1949, Farley, then production manager, was awarded an Alfred P. Sloan Fellowship for a year at MIT, where he studied industrial administration and earned an SM in 1950. He was named Richmond Engineering's VP for manufacturing in 1953. In 1961, he was named president of the firm's two subsidiary corporations, RECO Tanks of South Carolina and RECO Tanks of North Carolina. He was promoted to corporate executive VP in 1970 and was chair from 1977 until he retired in 1983. A native of Richmond, he graduated from Virginia Military Institute in 1937. In 1961, he was one of 24 former collegiate grid standouts named to *Sports Illustrated's* Silver Anniversary All-America team. He was a former president of the Virginia Society of Professional Engineers and a former member of the Virginia Manufacturers Association. During WWII, Farley served as an Army personnel officer at Frankfort Arsenal in Philadelphia and rose to the rank of major.

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SENIOR EXECUTIVES

The Association of Alumni and Alumnae was notified that Frank Herbert Barker-Benfield, SE '63, of Bucks, England, died on August 3, 1995. He was retired. No further information was provided.

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MANAGEMENT OF TECHNOLOGY

Philippe Bosquet, SM '89, and his wife, Mia, had their third child, Benjamin Bosquet, on August 3, 1995. . . . Akio Mitsufoji, SM '89, stopped by the Program Office and reported that he purchased a new home in Japan. Akio works for Toyo Engineering Corp. as deputy general manager in the industrial systems project and industrial systems sales and operations divisions. . . . Soo Sheung Wong, SM '91, and her husband, Hauke Kite-Powell, had their first child, Johannes Kite-Powell, '84, SM '86 (XIII), SM '88 (TPP), PhD '92 (XIII), on August 20, 1995. . . . Juan Carlos De Pablo-Olaiz, SM '92, joined the Spanish subsidiary of Tour & Andersson Control, a firm in Sweden that builds automation. Juan Carlos is the assisting manager in the engineering department, and is responsible for project design, planning and quotations, marketing, work methods, and systematic productivity improvements in the commercialization/implementation of engineering turnkey contracts. He received a PhD in 1995. His thesis examined business process management. . . . Chris Firth, SM '93, designed and now manages the new Citibank Singapore Web pages, located at <http://www.citibank.com/singapore>. Chris welcomes MOT alumni/ae to browse through

his new project, and send comments to him via the feedback form. . . . S. Amanda Chiu, SM '93, works at American Superconductor Corp. as the manager of strategic marketing. . . . Denis Malone, SM '94, is in charge of the Advanced Engineering Group at Industrial Research, Ltd. The group, composed of 45 researchers in Auckland, Wellington, and Christchurch, New Zealand, researches engineering dynamics, transport systems, communications, and production technology. . . . Via e-mail, Hitoshi Adachi, SM '95, reports that he is the coordinator of international business development of the patient monitoring systems division, the largest division of Nihon Kohden Corp. Hitoshi travels abroad quite often, and met with Adam Russell, SM '95, during his last trip to New York. Hitoshi also reports that his family purchased a new home in Tokyo. . . . Via e-mail, In-Kyu Lee, SM '95, reports he is now in the planning and administration department of the Living System Research Laboratory at LG Electronics in Korea. . . . Masayuki Saito, SM '95, relocated to Michigan in September and works in the electronics division of Yazaki EDS Engineering, Inc. . . . Via e-mail, Yuko Watanabe, SM '95, reports that she works as an internal consultant for the NEC Production and Innovation Program in Japan. . . . The MOT Program Office is happy to announce that the Management of Technology Program has a home page on the World Wide Web at <http://web.mit.edu/mot/www/>. Please browse the location and send comments to Rochelle Weichman at <mitmot@sloan.mit.edu>. —MOT Program, MIT, Room E52-126, Cambridge, MA 02139; e-mail: <mitmot@sloan.mit.edu>

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XVI AERONAUTICS AND ASTRONAUTICS

Professor Laurence R. Young, '57 (VI), SM '59 (VI), ScD '62, internationally recognized for his basic and applied research on the human aspects of space travel, particularly the vestibular function's role in "space sickness," has been appointed the first Apollo Program Professor of Aeronautics at MIT. Young, principal investigator in experiments on four space shuttle missions and an alternate NASA payload specialist for the Space Life Sciences 2 Mission in October 1993, delivered a lecture on November 20, 1995, to mark the establishment of the chair and his appointment. He is a member of the National Academy of Engineering and the Institute of Medicine, and a Fellow of the Institute of Electrical and Electronic Engineers. He was appointed to a faculty position in the department and co-founded the Man-Vehicle Laboratory. His psychophysical work on how the balance mechanism in the inner ear is linked to the "space sickness" that has bothered nearly all astronauts led to models that are used to help humans adapt to space travel and in-flight-simulator motion control. The work is being extended to include visually induced motion effects. Young is also recognized for his leadership in aerospace applications of manual control theory. . . . Rolf Dethlefsen, SM '62, ScD '66, founded Marx Technologies in San Diego, Calif., for

the implementation of Electric Pulse Power to industrial applications. . . . From Bethesda, Md., **Peter M. Bainum**, SM '60, reports: "I am a member of the International Astronautical Federation's Materials and Structures T.C. I was a co-chair of two sessions at the IAF Congress 1995 in Oslo. I was re-elected as VP of the international and American astronautical societies. I am a faculty co-advisor of the Howard University AIAA Student Branch with Sonya Smith." . . . **Joseph D. Antinucci**, SM '65, reports: "I am the president of Lockheed Martin in Orlando, Fla." . . . **Hisao Sal Miwa**, SM '81, writes: "I moved to a new house in Short Hills, N.J., in June 1995. My son, Michael is now 2 years old." . . . **Eugene J. Brunelle, Jr.**, ScD '62, writes: "I retired early in June 1994 and since then I have been listed in the following Marquis *Who's Who* volumes: *Who's Who in the World*, *Who's Who in America*, *Who's Who in Finance & Industry*, *Who's Who in Engineering & Science*, *Who's Who in American Education*. Now that these listings might "dress-up" my resume, I don't need a resume anymore!"

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XVII POLITICAL SCIENCE

Don Dickson, PhD '75, of Burlington, Vt., writes: "I am president of Housing Vermont, a statewide nonprofit developer of affordable housing." . . . **Leonard Brown, Jr.**, SM '57, writes: "I am the president of Boston Building Consultants, Inc., a structural engineering firm. My son, Tim, is at MIT in the Real Estate Development Program and is playing rugby as I did 38 years ago!" . . . From Fairfax Station, Va., **Franklin D. Margiotta**, PhD '79, reports: "As publisher at Brassey's, Inc., I recently edited and published the *Brassey's Encyclopedia of Military History and Biography*. I am currently working as the executive editor on three more encyclopedias on air, land, and naval forces and warfare." . . . **Ming Ivory**, PhD '86, writes: "I finally have the job for which I've been preparing all these years. I was recently appointed associate professor of Integrated Science and Technology at James Madison University in Harrisonburg, Va., where I am teaching and designing non-technical (politics, economics, ethical, sociological) curriculum components of this innovative program designed to produce graduates who can serve as science and technology managers for industry, government, and nonprofit sector."

Larry Levine, PhD '82, was named VP for content at US WEST, Inc. Levine had been VP and general manager of US WEST Communications Broadband and Multimedia Services Group since January 1994. In that role, he was responsible for the development and successful deployment of the TeleChoice Network market trial in Omaha. In his new role, Levine will be responsible for working with US WEST Communications Group and with US WEST Media Group to determine domestic and international cable programming needs, develop and implement a worldwide content strategy, and cultivate strategic content relationships for US WEST. "Larry's

experience in forming key content relationships for the Omaha TeleChoice Network trial, as well as his international and media consulting experience, makes him ideally suited for this position," said John O'Farrell, president of US WEST Interactive Services Group. "US WEST is building one of the world's largest distribution footprints," Levine said. "We have a great opportunity to maximize our distribution strengths if we approach the content community in a focused fashion. We also have an opportunity to work more closely with our existing content partners." Levine joined US WEST in June 1991 as director of market strategy development for US WEST, Inc. As a member of the US WEST Strategic Marketing team, he focused on international cable and telephone opportunities, and on video and entertainment strategies. Prior to joining US WEST, he was a senior consultant for Arthur D. Little Media and Entertainment Consulting Group, where he advised entertainment industry clients in areas of strategy, new business development, and organization. He holds an MA in communications from the University of Wisconsin.

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XVIII MATHEMATICS

Selected Works in Applied Mechanics and Mathematics by **Eric Reissner**, PhD '38, MIT professor emeritus of applied mathematics, was published by Jones & Barlett in 1995. The collection contains about one quarter of Reissner's papers, a survey of his other papers, and a biographical sketch. The preface is by T.J. Lardner, a former postdoc of Reissner's, and three of Reissner's former students who later became his collaborators and friends: **Satya N. Atluri**, ScD '69 (XVI); **J.G. Simmonds**, '58 (XVI), SM '58 (XVI), PhD '65; and **Frederic Y.M. Wan**, '59, SM '63, PhD '65. Reissner taught mathematics and a graduate course on the theory of elasticity at the Institute from 1939 to 1969. Reissner and his wife, Johanna, live in Solana Beach near UC/San Diego, where he served as professor of applied mechanics from 1970 to 1978.

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XXII NUCLEAR ENGINEERING

Walter H. D'Ardenne, PhD '64, of San Jose, Calif., reports: "I retired from GE Nuclear Energy on December 31, 1993. My wife, Peggy, and I do a lot of traveling—two to four major trips per year. I am also still active in national and international nuclear safety standards." . . . **Matthew Siegel**, SM '89, NUE '89, a 1994 graduate of Yale University's graduate school of management, is currently working for Booz Allen & Hamilton as a management consultant. He resides in New Canaan, Conn., with his wife and their 2-year-old son. . . . **Kenneth Poorman**, SM '94, reports: "In August 1995, I moved to Pearl Harbor, Hawaii. I am currently serving as

reactor controls assistant on board the USS *Columbus*. In September, I was promoted to a full lieutenant." . . . **James K. Liming**, SM '83, writes: "As a senior consultant at PLG, Inc., in Newport Beach, Calif., I conduct risk assessment and reliability analyses for complex systems processes, and facilities worldwide. I am a commander in the U.S. Naval Reserve and serve in the Naval Sea Systems Command Industrial Mobilization Detachment 319."

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XXIV LINGUISTICS AND PHILOSOPHY

Mark P. Kriger, SM '75, reports "I started a position as professor in Strategic Management at Sandrika in Norway in September 1995. Norway is a spectacular country!" . . . The American Psychological Association presented its William James Book Prize to **Steven Pinker**, professor of psychology. The prize, given for the book that best integrates the different areas of psychology, was given to Pinker for his 1994 book, *The Language Instinct*.

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TPP TECHNOLOGY AND POLICY PROGRAM

In May 1995, **Pascal Remy**, SM '87, joined the firm DEGREMONT as executive VP. . . . **Mia Paget Bosquet**, SM '89, sent a wonderful photo of daughters Ariane and Audrey proudly presenting brother Benjamin who was born August 3, 1995. . . . **Ken Meyers**, SM '87 (XXII), SM '89, is the director of strategic planning at Simulation Sciences, which develops and services process simulation tools for designing, constructing, operating, and maintaining process plants. His responsibilities include developing and implementing strategic planning framework as well as designing corporate-wide sales, marketing, and business operations processes. . . . **John Steve Thomas**, SM '92, is a financial engineer at ABN-AMRO Bank in Chicago. Steve and Chantal have two children, Julien and Camille. . . . **Katsuki "Katz" Oshiden**, SM '93 (I), is an assistant manager in the digital technology department at Mitsubishi Research Institute, Inc. Katz also works part-time for TV Asahi. He recently stopped by the TPP office while on holiday to Boston and the Cayman Islands.

Alice Caponiti, SM '95 (XXII), works at the U.S. Department of Energy, where she is responsible for disposing of surplus plutonium. . . . **Raymond Joe**, '90, SM '95 (XIII) is attending law school at the University of Michigan. . . . **Dimitris Politis**, SM '95 (XVI), is an associate in the business consulting department at Charles River Associates in Boston. . . . **James Hamilton**, SM '96, and his wife, Sue, are the proud parents of Katelyn Rose, born on Wednesday, October 4, 1995.—Richard de Neufville, TPP, MIT Room E40-252, Cambridge, MA 02139; e-mail: <tp@mit.edu>

Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

Herbert Arthur Dyer, '18; January 12, 1995; North Branch, N.Y.
Timothy Edward Shea, '19, SM '19; June 19, 1995; Paramus, N.J.
William Bull Elmer, '22; September 5, 1995; Campton, N.H.
Harry Green, '23; October 28, 1995; Roslindale, Mass.
Edgar Richard Curtis Ward, '25; August 19, 1995; Falmouth, Me.
Samuel Richard Spiker, '25; November 2, 1995; Dublin, N.H.
Alexander Hanks Brown, '26; October 26, 1995; Nashua, N.H.
Susan D. Mattuck, '26; May 20, 1995; Weston, Conn.
F. Martin Towle, '26; June 7, 1995; San Mateo, Calif.
Lyndall Raymond Perry, '27; August 30, 1995; Mendham, N.J.
Henning Waldemar Hanson, '28; February 9, 1995; Whitman, Mass.
Sarkis Giragos Sarkisian, '28, SM '31; August 9, 1995; Belmont, Mass.
Benjamin Christian Buerk, '30; August 23, 1995; Buffalo, N.Y.
Frederick Lawrence Garvin, '30; August 3, 1995; Reading, Mass.
Charles Fulton Parker, '30; September 14, 1995; Gorham, Maine
Anthony Ralph Savina, '30; August 28, 1995;

Stamford, Conn.
Stanley Sherman Rudnick, '32; March 9, 1995; Denver, Colo.
Robert Burton Kinraide, '33; August 31, 1995; Westwood, Mass.
Horace Leavenworth Newkirk, '33; September 26, 1995; Santa Rosa, Calif.
Turner Wright Gilman, '34; September 1, 1995; Hanover, Mass.
George Richard Lawrence, '34; September 10, 1995; New London, N.H.
Edmund Quincy Sylvester, '34, SM '37; August 31, 1995; Cleveland, Ohio
Benjamin Franklin Schlimme, SM '35; August 10, 1995; Tucson, Ariz.
James Golladay Baker, '36, SM '37; March 3, 1995; Madisonville, Ky.
Herbert Mowry Borden, '36, SM '37; September 9, 1995; Taunton, Mass.
Philip Bliss, '37; October 18, 1995; Newington, Conn.
Jack Kayn Yan Hum, '38, ScD '51; January 16, 1995; Berkeley, Calif.
Jerry McAfee, ScD '40; October 14, 1995; Pittsburgh, Pa.
Vincent Theodore Elkind, '42; July 14, 1995
Robert Adams Frost, '42; September 4, 1995; South Dartmouth, Mass.
Arie Andrew Van Teylingen, '42; July 23, 1995; Algona, Wash.
Anibal Becher, SM '44; June 26, 1990; Buenos Aires, Argentina
Robert Gilbert Striker, '46; February 21, 1995; Port Washington, N.Y.
John Karmazin, '47; October 24, 1995; Grosse Ile, Mich.
Stanley Stanley Kordys, '47; September 20,

1995; Newark, N.J.
Frank Moderno Sanger, SM '48; January 13, 1995; Falls Church, Va.
Richard Harbert Smith, '48; August 26, 1995; Sherman Oaks, Calif.
William Fryer Wicks, '49; June 12, 1995; Reston, Va.
James Howland Ballou, '51; August 3, 1995; Salem, Mass.
Frederick Gliessmann Lehmann, '51; November 15, 1995; Denver, Colo.
William Melton Wallace, '51; May 22, 1995; Gainesville, Ga.
James Marsh Margolis, '52; February 28, 1984
James David Robertson, PhD '52; August 11, 1995; Durham, N.C.
Vernon Gaylord Plank, SM '54; October 12, 1994; Mansfield, Mass.
Hart Monroe King, SM '56; February 27, 1994; Oshkosh, Wis.
Roger Andrew Baust, '60; September 6, 1995; Southborough, Mass.
Aditya Vikram Birla, '64; October 8, 1995; Bombay, India
Jose Ignacio Avellaneda-Navas, SM '67; June 30, 1995; Gainesville, Fla.
Bruce Frederick Becker, SM '70; April 30, 1993; Bloomfield Hills, Mich.
Shui-Tien Hsieh, '74, SM '78; September 16, 1995; Brandamore, Pa.
Sheri Abrams, '76; October 26, 1995; Los Altos, Calif.
Michael James Blazquez, '80; March 1, 1995; Blauvelt, N.Y.
Steven Paul Somes, SM '83; October 18, 1995; Wellesley, Mass.



HERE MIGHT
A NAME BEST LIVE?



The name of a deceased MIT alumna or alumnus can be linked to the Institute through gifts made by classmates, colleagues and family. Memorial gifts can be unrestricted or directed toward scholarships, research or any program of the Institute. The Institute notifies bereaved families of the name of each donor, and each gift becomes a part of MIT's permanent record.

Named endowed funds whose income supports the work of the Institute in perpetuity can be established with larger gifts. If you would like information on ways of expressing sympathy through a memorial contribution, or on establishing a named endowment fund, please contact Betsy Millard, MIT Room E38-202, Cambridge, MA 02139 or call (617) 253-8059.

PuzzleCorner

As I reported a few months ago, this past summer I turned 50 and was “treated” to the expected gifts for someone reaching this milestone (jars of Metamucil, membership in AARP, etc.). Well the latest reminder that I am, to quote the president of NYU, “experience advantaged” came from home: I now find myself pleading, shouting, and jumping up and down trying to get my teenage son to turn down the volume on his electric guitar. Although I won’t tell him this, I do remember playing records (you know those vinyl, oversized, CDs stored in cardboard) by groups such as the Jefferson Airplane at high dB ratings myself. NOTE: Bridge and Chess problems are in very short supply. If there is a desire for us to continue publishing such problems, please submit your favorites.

Problems

F/M 1. In the hand below, submitted by Doug Van Patter, the bidding was short and sweet: South opened with 1H, West bid 2C, North bit 4H, and everyone then passed. How can South make the contract after an opening lead of the King of Clubs?

F/M 2. Eugene Sard begins this month’s offerings with a geometry problem. Given a triangle ABC, find a geometrical construction of a point X that minimizes the sum S of the lengths AX+BX+CX. Calculate the value of S in terms of the side lengths AB, BC, and CA.

F/M 3. Warren Himmelberger asks a variation of the birthday problem that he first encountered in *One Hundred Mathematical Curiosities* by William Ransom. What are the odds that (at least) two people in a random group of 16 people have birthdays on consecutive days? Now replace 16 by 30.



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO: ALLAN GOTTLIEB
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715 BROADWAY, 10TH FLOOR
NEW YORK, N.Y. 10012,
OR TO: GOTTLIEB@NYU.EDU

Speed Department

For many of the early years of “Puzzle Corner,” John Mattill was the editor I reported to. Now editor emeritus, John sends us this quicky suggested by Professor Alan Guth. A year is about 365 1/4 days long. Describing the earth from the point of view of an inertial reference frame, how many times a year does the earth rotate about its axis?

Solutions

OCT 1. We begin with a chess problem from Richard Freedman. White to move and mate in 2.

							BP
					wp		BK
					wk	BP	wp
	wp		wb	wb			
	wr	BB					

The proposer and several readers claim that Black’s last move must have been b7-b5 and hence White can now capture en passant and then mate the next move. However, Mike Mulligan points out that the previous moves for White and Black might have been Pxf6 check, K-h6 in which case no en passant is possible. Other readers suggested the solution B-b4, any; B-g8 mate but I believe they overlooked B-b4, P-g4; B-g8 KxP. Hence I conclude that there is no mate in two. Sorry.

OCT 2. Here is a pair from Nob Yoshigahara: Consider a number factored into primes.

$$a = b \cdot c \cdot d \cdot \dots$$

The first goal is to find an example

where the equation contains all nine digits 1-9, exactly once each. The second goal is similar but involves the ten digits 0-9.

Steve Feldman (with the help of an anonymous Basic interpreter) sent us the following solution.

I wrote a Basic program to spin through values of “a,” factor them and compare the various digits. for the first problem, I came up with

$$5986 = 2 * 41 * 73$$

$$8614 = 2 * 59 * 73$$

To the second problem, I came up with

$$28651 = 7 * 4093$$

$$65821 = 7 * 9403$$

I find it interesting that the solutions to the first problem contain 2 common factors, and the solutions to the second problem contain the same digits in “a.”

OCT 3. Bob High first had this problem appear in *New Scientist*: Uncle Fibo is on a brief, enforced vacation from the racetrack. Missing the excitement of the turf, he has come up with a substitute: he and his associates—Earl Garth and Hal—have among them a single coin. They flip this coin repeatedly, producing a sequence of heads and tails. Each man has a “horse”—a sequence of three heads or tails—and the one whose horse appears first wins the “race”.

For example, suppose Uncle Fibo chose HTH and Earl chose THT, and these two had a race. If the coin produced the sequence, H H T T H T..., then Earl would win.

On the particular day of interest to us, the men have chosen the following horses: Earl, HTT; Uncle Fibo, HHT; Garth, THH; and Hal, TTH. They run four separate races: Earl against Uncle Fibo; Uncle Fibo against Garth; Garth against Hal; and Hal against Earl. Assuming their coin is fair, who would you expect to win each race?

The following solution is from Matthew Fountain

Fibo (HHT) defeats Earl (HTT) 2

Continued on Page MIT 32

MIT LIFE INCOME FUNDS

MR. AND MRS. ROGER A. KREY

HOME: Mirror Lake, New Hampshire

CAREER: During the war, Roger Krey ('36, ME) served as a flight officer in a U.S. Army Troup Carrier Group, flying gliders that carried jeeps and soldiers onto the battlefield. Completing his war service in 1945, he went on to teach mechanical engineering, start an automotive power testing firm, and then work for an RCA development laboratory where he specialized in bonding metal to ceramics for glassless electron tubes and for nuclear activated solid-state power producers used in space vehicles. In 1964, he returned home to New Hampshire, where his main business interest has been recreational real estate. He holds three patents, one each in chemical, mechanical and electrical engineering.

Roger has served on two public environmental planning bodies and takes part in other environmental activities. A believer in broadening his own experiences, he resumed motorcycling at 65 and attended hang gliding school at 71. Today he continues a lifelong interest in Models T and A Fords, and still drives the 1929 Ford he used to commute to MIT as an undergraduate.

Roger and Barbara Krey met in England in 1945 and married in 1952. They have four children and two granddaughters.

MIT LIFE INCOME FUND: Barbara M. and Roger A. Krey Scholarship Fund, honoring Professor Emeritus Charles Fayette Taylor.

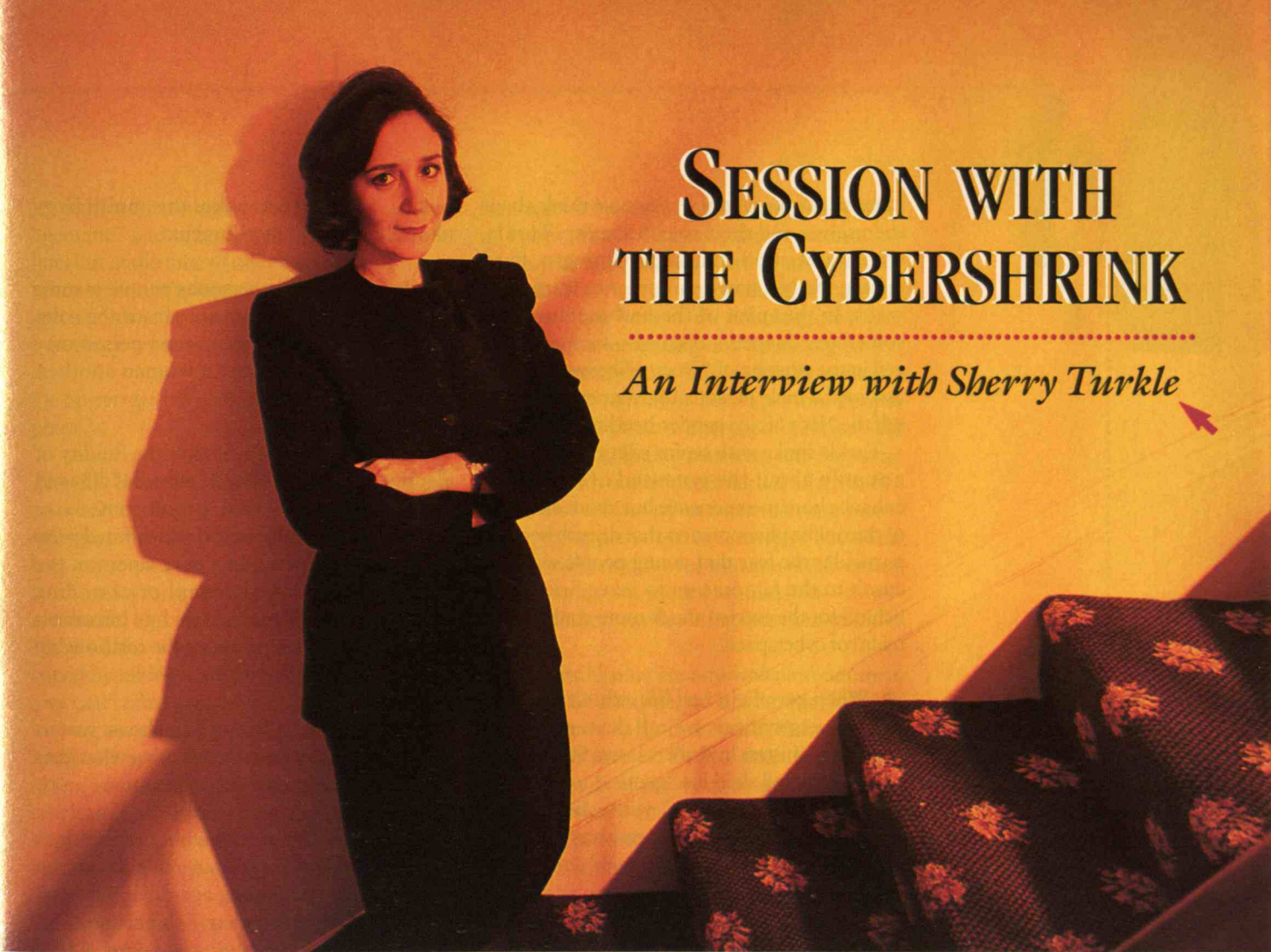
QUOTE: No financial transaction in my life has been more satisfying—I gave MIT some lakeside recreational property that would have generated large capital gains and MIT used the proceeds of the sale to set up our charitable remainder unitrust. Barbara and I receive quarterly payments from the interest, and for a few years we also enjoy substantial reductions from our gross income.

For more information about MIT Life Income Funds, write or call D. Hugh Darden, W. Kevin Larkin or Frank H. McGrory at MIT, Room 4-234, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139-4307; (617) 253-3827.

Photo: Richard Howard



DONORS' PROFILE



SESSION WITH THE CYBERSHRINK

An Interview with Sherry Turkle

ATTEMPTING TO UNLOCK HER OFFICE door, Sherry Turkle fumbles with her keys. She tries one way, then another. After good-naturedly grouching about the recalcitrant lock—so much more troublesome than opening a fresh window on a computer screen—Turkle finally succeeds, and the door swings open to a most uncybernetic office: wicker furniture, riverside view of the Boston skyline, photo of her four-year-old daughter. Surely a computer lurks somewhere in this den of the reigning psycho-guru of cyberspace, but it is tastefully unobtrusive.

Turkle has established herself as the Margaret Mead of the computer culture. Her 1984 book *The Second Self: Computers and the Human Spirit* examined the way people interacted with personal computers, just then becoming a common appliance. The book catapulted her into the pantheon of academic super-

*While the
online experience can
enrich and expand
people's lives, it can also
seduce the vulnerable
into ignoring the
real world.*

stars: *Ms.* magazine named her its woman of the year, and *Esquire* entered her in its "registry of America's new leadership class."

The Brooklyn-born Turkle, with a joint doctorate in sociology and psychology from Harvard University, is a professor in MIT's Program in Science, Technology, and Society. Her interest in concepts of identity predates her fascination with computers; she has written extensively about psychoanalysis, and rarely does she give an interview or lecture without referring in some way to Freud, whose division of human identity into id, ego, and superego presaged the infinitely more diverse personas that people voluntarily assume in their travels through cyberspace.

Her latest book—*Life on the Screen: Identity in the Age of the Internet*, published in November by Simon and Schuster—assesses the impact of com-

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enthusiasts,
“real life” is
just another
window,
equivalent
to the ones that
represent their
invented
personas
in virtual
communities.

puter networks on the way people think about themselves and their role in society. Turkle, who is a licensed clinical psychologist, lived among the Net natives in order to learn their ways. In the spirit of the new medium, she sometimes donned a disguise—such as a thin veil in the persona of “Doctor Sherry,” or even assumed a male persona to experience for herself the Net’s fabled gender-bending abilities.

Turkle spoke with senior editor Herb Brody not only about the potential of the Net to enhance human experience but about elements of the online phenomenon that disturb her—in particular the fear that young people will succumb to the temptation to leave “real life” behind for the ever-so-much more controllable realm of cyberspace.

TR: When people in real life exhibit multiple distinct personalities, we call them psychotic, or at least sinister: In Robert Louis Stevenson’s story, Dr. Jekyll shed his “gentle doctor” identity to liberate the “beast” within him as Mr. Hyde. Why are multiple personas not only accepted on the Net but considered cool?

TURKLE: People who suffer from multiple personality disorder have fragmented selves where different pieces are walled off from the others—often in the service of protection from traumatic memories. People who suffer in this way can have the experience of opening their closet in the morning and not knowing who bought some of the suits inside it. By contrast, people who assume online personas are aware of the lives they have created on the screen. They are playing different aspects of themselves and move fluidly and knowledgeably among them. They are having an experience that encourages them to challenge traditional ways of thinking about healthy selves as single and unitary.

TR: How so?

TURKLE: We live an increasingly multi-roled existence. A woman may wake up as a lover, have breakfast as a mother, and drive to work as a lawyer. A man might be a manager at the office and a nurturer at home. So even without computer networks, people are cycling through different roles and are challenged to think about their identities in terms of multi-

plicity. The Internet makes this multiplicity more concrete and more urgent.

TR: But the multiple personas people assume online are of a different sort from the roles you’ve described. In cyberspace a person may be a man sometimes and a woman another, for example.

TURKLE: Yes, cyberspace takes the fluidity of identity that is called for in everyday life and raises it to a higher power: people come to see themselves as the sum of their distributed presence on all the windows they open on the screen. The technical metaphor of cycling through computer windows has become a metaphor for thinking about the relationship among aspects of the self.

TR: So cyberspace is kind of a fun house mirror of our society—essentially reflecting what goes on off-line, but with some exaggeration?

TURKLE: Yes. And in a way, because it does allow for an extravagance of experimentation—with gender switching, age-flexibility, and all the rest made so easy—experiences in cyberspace are challenging us to revisit the question of what we mean by identity.

TR: But in the frenzy of attaining multiple identities, some people seem to be losing the sense that their “real world” self is any more important than their menagerie of online personas. In your book you describe one young man who tells you that for him, real life—RL, as he calls it—doesn’t have any special status. It’s just another window, along with the ones where he plays roles in a number of virtual communities.

TURKLE: Right. And he said RL is usually not even his best window.

TR: That sounds obsessive. Do you encounter that attitude a lot?

TURKLE: It’s not uncommon. But for me, his case is important because it demonstrates how a bright young man who is doing well in school and who has real-life friends can easily go through a period when things are more interesting on the Net than off. This is what

leads him to see his online experiences as a "genuine" part of his life. He still had a life offline, but at the time of our conversation, events there were not going so well. From this perspective, the comment about RL not being his best window seems a bit less sinister.

TR: So retreat into online community is just a phase?

TURKLE: It can be. And in some cases it is not so much a retreat as a first step in developing strengths that can be brought into "real" life. I met a student who had a very bad time in his freshman year in college. His father was an alcoholic, and he was dealing with his own sense of his vulnerability to alcoholism. He coped by taking a job of great responsibility in a virtual community. When I met him the following summer, he was interested in going back to try things out in RL. In the best of cases, positive online experiences leave their mark on both the virtual and the real. And they can change the way people see their possibilities; it can affect self-esteem.

TR: Are social skills acquired online applicable in RL?

TURKLE: They can be. Much of what it takes to get along socially are things like having enough self-esteem to be willing to take risks, to have somebody not like you and yet be able to move on, to be able to take no for an answer, to not see things in black and white. An absence of these skills can make life on the Net seem attractive as a place of escape. But they can be learned by interacting with people within virtual communities. That's why I don't get upset that people, even children, are spending a lot of time online. They may be working through important personal issues in the safety of life on the screen. They may come out the other side having had some experience they're able to use to make their lives more fulfilling.

TR: Can casual relationships formed online survive the transition to the real world, where it's not so easy to hide behind an invented identity?

TURKLE: Sometimes, online relationships do not survive the voyage to the real. But in other cases, they survive very well. I know of real-life

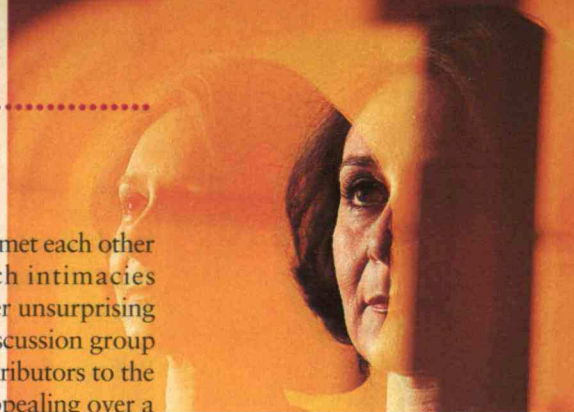
marriages between people who met each other in cyberspace. The way such intimacies develop usually follows a rather unsurprising pattern. You're in an online discussion group and you "hear" one of the contributors to the group sound interesting and appealing over a three-month period. You're finally going to want to talk to him or her in person. People want that flesh-and-blood connection. Of course, this can lead to problems too. Someone may begin an online extramarital affair thinking of it as a form of interactive erotic literature, typing provocative sentences back and forth, and then discover that the involvement has become a lot more complicated—something that they want to bring into their real life.

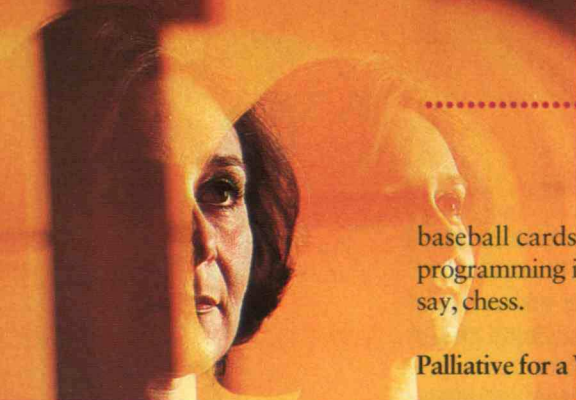
TR: Parents I know are ambivalent about their kids' use of computers. It's wonderful that children have this other world that they can inhabit and master. On the other hand, there seems to be an element of compulsion that's not particularly attractive. There are only so many hours in the day, and time spent on a computer is time not spent with friends, family, playing sports, or just reading.

TURKLE: If the computer is replacing time with peers and parents, that's not good. But if the computer is replacing television, then that may well be an upgrade.

TR: Do you worry that some people—children in particular—might be becoming addicted to computers?

TURKLE: It's not an addiction like with cocaine, where everyone on it develops a physical dependency, which is never good. When people respond to the holding power of computers, the situation is far more complex. A person can use computers in different ways at different times, and for different developmental tasks. A six-year-old who uses a computer, for example, may be working on an issue of mastery. A year later he may have shifted his attention to baseball cards. Both are developmentally appropriate, and there's little reason to think that mastery of the online world is much different from mastery of box scores in baseball. This is especially true now that kids can share their experiences online in much the same way that they can share their interest in





baseball cards. In the same sense, computer programming is not that much different from, say, chess.

Palliative for a Vulnerable Time

TR: Many of the people you study are students attending college—traditionally a time when people leap into political activity. Are these young adults using the Net to try to change the world?

TURKLE: As someone whose political sensibilities were developed in the 1960s, I'm sorry to say that I see some evidence that things are not going in that direction. I talked with one young man of 22 or 23, who told me how involved he is in political activity within one of the Internet's virtual worlds—a multi-user domain (or MUD) where people create characters and build their own virtual living and working spaces as a backdrop for their online social lives. He just loved the grassroots feel of the involvement. Since this was right before the last congressional elections, and some key seats in his home state were up for grabs, I said, well—what about real-life politics? He said no, that was of no interest to him: politicians were all cynics and liars. Part of me wanted to cry.

TR: Why do you find that so disturbing?

TURKLE: I hear many of the people I interview expressing a genuine confusion, a sense of impotence, about how to connect to the political system. In cyberspace, they feel they know how to connect, how to make things happen. This is disturbing because as of now, most of the community life in MUDs and other virtual places has little effect in the real world—these online societies essentially disappear when you turn off your computer. It would be exciting to see online communities used more to address real-world social crises such as those around the environment, health, drugs, and education. This is starting to happen; I would like to see more of it. Online activists are learning a great deal as they build virtual worlds—it's like thousands of social experiments being conducted simultaneously, all over the world. I would like to see some of the knowledge gained from these efforts used to

improve our off-line communities.

TR: Why do you think some young people are withdrawing from real political involvement and jumping instead into cyberspace?

TURKLE: For some people I interviewed who are in their twenties, cyberspace offers them a status that RL does not. These people grew up in middle class families, went to college, and many feel that they are slipping out of the middle class. They work jobs in fast food or sales, most share apartments, some have moved back to live with parents. They're not living in the way they were brought up to think somebody with a college education would live.

TR: But in cyberspace, they have higher status?

TURKLE: Right. In cyberspace they feel that they have rejoined the middle class. They are spending time with people whose interests and cultural background they recognize. They feel at home and in a political environment where they can make a difference. As one person put it, "I have more stuff on the MUD than off it," meaning that in her virtual community, she was able to build and furnish her own "room." Meanwhile, the real-world culture is supporting this notion with the hype that computers are sexy, that cyberspace is where it's happening. But I think that some of this hype can encourage a notion that what we do to the physical environment, say, doesn't count because we're creating a new environment in cyberspace. You don't want to lose a sense of urgency about the state of your city because you feel you have this other ready alternative. Yet, this is what I pick up in the attitudes of many cyber-enthusiasts I speak to.

TR: That would seem to be a self-fulfilling prophecy—as people withdraw from the real world, their talents are not available to solve our real problems. But they are available in cyberspace, which then becomes a more and more attractive option.

TURKLE: Yes. As a society, we are at a particularly vulnerable point. There is a tremendous amount of insecurity about what kinds of jobs we are going to have and where they will be. How are we going to address the serious prob-

lems facing our children: drugs, violence, deteriorating education? How are we going to address problems of the environment and of cities and of health care? Do we have the political will to attempt to do all of these things? The challenges seem overwhelming. So people are very susceptible now to the notion that there's a better place—somewhere over the rainbow, way up high, where there isn't any trouble. Of course, that place is the online world. In other words, our confusion and insecurity make us want to believe that there is a technological alternative.

Having It All

TR: Why do you think there's been a recent backlash against the Internet, with the publication of critical books and articles?

TURKLE: There are several reasons. Partly it is opportunistic—after a lot of hype, people sense that it's the right time in the news cycle to present a contrary point of view. Also, the same frustrations and the same desire for an easy fix that leads people to the safety of the Internet leads people to complain about it rather than other things. We don't know what to do about violence or about the poor quality of education in many schools. We don't know how to bring families back together. It's easy to blame technology for our ills. So you see the widespread fantasy that what's causing moral decay in America is online pornography. People are spending a lot of political capital making waves about the urgency of cleaning up the Internet. I think that energy might be better spent elsewhere.

TR: Pornography on the Net doesn't overly concern you?

TURKLE: Do I want my four year old sitting there scrolling through filthy pictures? Of course not. But I would rather not interfere with free speech and I prefer to keep the monitoring of children as something that gets done by parents in the home rather than have government agencies policing cyberspace. Yes, there is pornography online. But we should be able to recognize that it is a displacement of our social anxieties to be focusing disproportionately on cyberporn as a pressing problem.

TR: Many critics seem turned off by how shallow the Internet is, both in its informational content and in the kind of relationships it fosters.

TURKLE: When a new technology is introduced, people respond by complaining that it's not as good as what we have had before. But it is hard to argue that online information doesn't compete favorably with what television offers. And online communication is in many ways a return to print—to reading and writing. In any case, it has usually worked out that the introduction of a new medium does not displace the old in any simple sense. Television didn't kill movies, and neither did video games.

TR: So instead we end up with everything.

TURKLE: Yes—that seems to be a general pattern. I do not believe that people are going to choose between relationships in cyberspace and face-to-face relationships. I think that people are going to have all kinds. It's not going to be one or the other. What I'm interested in—psychologically, socially, and politically—is making real life more permeable to cyberspace and cyberspace more permeable to real life. We need to think of ways to make the resources that are online have a positive impact on real life.

TR: But such “permeability” could come at a cost. For instance, if kids pursue more education through the Net and less through schools with other kids, won't they miss much of the socialization that schools have traditionally provided?

TURKLE: Well, in that sense the advent of a new technology leads us to ask what it is we most value in our way of life. Do we care, for example, about public schools? Because if the schools continue to deteriorate, and pose physical dangers, and an online alternative arises, then who could blame parents for keeping their kids home and having them just log on instead? It's a rational choice. Now if you don't like that, if you think that kids ought to be getting an education with other children, then you have to be willing to pay for it. And that will mean investing public money to make

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the schools better and safer. Online possibilities are forcing us to examine what we really care about. They are serving as a kind of a wake-up call.

Not All Boys and Their Toys

TR: Has the rise of the Internet made the computer culture more female-friendly?

TURKLE: Definitely. Computer technology is moving in a direction that makes it easier for women to see it as something that is culturally theirs. We're hearing a lot less of that stuff about girls having "computer phobia," which I never thought was a good way to explain what was going on.

TR: You don't think girls have tended to be more apprehensive than boys about using computers?

TURKLE: Maybe they were at one time, but the label "phobia" does not correctly describe the phenomenon and does not help girls get over what some of them feel, which is much more like computer *reticence*. Girls weren't afraid of computers, but many felt that dealing with a computer was just not very girl-like. The computer was culturally constructed as male, just as much of technology was. When I was a girl, I once wanted to build a crystal radio. My mother, usually very encouraging, said no, don't touch it, you'll get a shock. It wasn't that I didn't want to build it—I wasn't phobic. But somehow, this just wasn't what girls did. I became reticent about such things.

Traditionally, the computer culture has carried many associations that tended to alienate girls—I mean, if you made a mistake, the computer asked you if you wanted to "abort" or "execute" or "kill." Those words convey images that just didn't appeal to a girl. Also, computers took you away from people.

TR: But the Internet is making the computer more of a social tool?

TURKLE: Yes—using computers today tends not to involve conquest metaphors or isolation from other human beings. Interfaces encour-

age you to manipulate them, to play with objects on the screen as though they were tangible entities, like elements of a collage. And the Net is all about chatting with people, being with people. Women who get onto the Net are often turned off by the flaming and the ad hominem rudeness they see. But they find places on the Net where this is not the case, and when they don't find them, they can create them. The Net desperately needs more of the characteristics that in our culture have been associated with women—skills such as collaboration and diplomacy. And many online communities are not only civil but actively encourage friendships and networking—it's not all boys and their toys.

TR: Still, the Net remains mostly male, doesn't it?

TURKLE: Women are present on the Net in greater and greater numbers. But I am often struck by the preponderance of messages that seem to come from men, even in places where there are many women around. Women tend to be less visible than men because when confronted with a rowdy group-flame session, women will move their conversations to private e-mail.

TR: Is there some way that women are using the Net more than men are?

TURKLE: Many women are getting access to the Internet in order to keep in touch with their families. For example, a parent with kids at college can use the Net to communicate with them. Parents know that their kids are logging on every day to get their e-mail. They're not going to resent an e-mail message from mom the way they might resent a badly timed phone call. A channel of communication that wasn't there before is opening.

TR: Does this new channel lead to new kinds of interactions?

TURKLE: Yes. A parent can send e-mail to a child away at college, saying, you know, it's 3 o'clock in the morning, I couldn't sleep, I was watching an old movie, I just thought I'd send you a note. In one case when this happened, the child, a freshman at college, responded immediately to a note from his mother and

told her that he was up too—studying for a chemistry exam. The mother wrote right back, I wish you luck. The son appreciated the nurturance, something that he would not have permitted himself if he had had to call home. So all of a sudden you have an interaction that gratifies both people that never would have happened.

TR: So for many women, the Internet is a way to strengthen family ties?

TURKLE: Yes. Of course, the appeal of cyberspace for communication with family also draws in many men as well. And once they're in touch with their kids, why shouldn't they join a newsgroup about investments?

The Peril of the Black Box

TR: Time was, effective use of a computer required at least a basic understanding of how the machine worked. One benefit of more advanced computers is that this is no longer the case—people can now control a powerful technology without knowing much of anything about how it operates. What are the consequences of relying on a technology that is so opaque?

TURKLE: I'm very concerned that technology may be fostering a kind of intellectual passivity, feeding into a cultural acceptance of a lack of understanding of how a lot of things work. I'm troubled by people's sense that this is all basically magic. I don't think people should have no idea how computer technology works. And increasingly, people have no idea. I interviewed one man who said that when BMW started using microchips in its cars, he lost interest in them although he had been an avid enthusiast. For him, the cars had become opaque. He enjoyed transparent technology because it made him feel more empowered to understand other things in his world. I have a lot of sympathy for his perspective.

TR: Cars that use computer chips need less maintenance and run better. A Macintosh is usable by millions more people than a DOS or Unix computer. Aren't such benefits worth the loss of "transparency"?

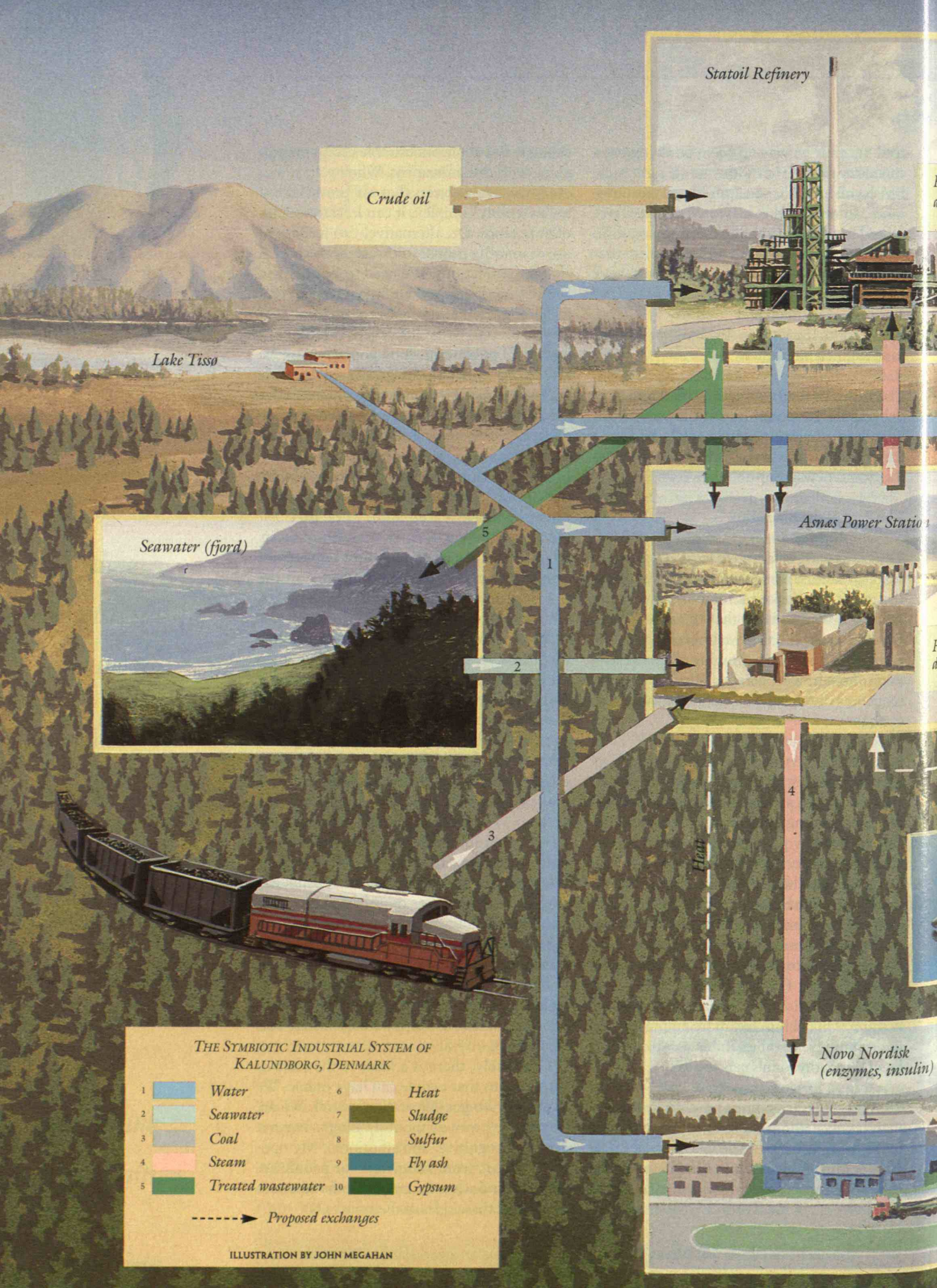
TURKLE: But some undesirable things may go along with this movement. When people deal every day with objects that are powerful but impenetrably complex, it can lead to feelings of impotence. Or, alternatively, to feelings of unreasonable power and retreat to radical oversimplifications. We need to be attentive to the social and psychological impact of a technology that encourages you to think that all you need to do is click, click. Double click and make public education go away. Double click and make taxes go away. Double click—three strikes and you're out and solve the crime problem. As a society, we're doing a lot of double clicking. And I think it is not a bad thing for us to get a better understanding of how this mentality might be flowing out of the habits of thought encouraged by our technology.

TR: All in all, are you an optimist or pessimist about the effects of the computer on the human psyche?

TURKLE: I think that computers offer dramatic new possibilities for personal growth—for developing personal senses of mastery, for forming new kinds of relationships, and for communicating with friends and family all over the world in immediate, even intimate ways. But I don't like thinking of things in terms of optimism or pessimism because it makes it sound as though one gets to take bets on whether the technology is going to have one kind of effect or another. I think that a lot of the effect of computers and the Internet is going to depend on what people do with it. We have to see ourselves as in a position to profoundly affect the outcome of how things are going to go. Hying or bashing technology puts the emphasis on the power of the technology. I'm trying to put the spotlight on people, and the many human choices we face as we try to assimilate this technology.

Ultimately, there is a limit to the sorts of satisfactions that people can have online. We live in our bodies. We are terrestrial. We are physical as well as mental beings—we are cerebral, cognitive, and emotional. My optimism comes from believing that people are going to find ways to use life on the screen to express all these sides of themselves. ■





Crude oil

Statoil Refinery

Lake Tissø

Seawater (fjord)

Asnes Power Station

Novo Nordisk
(enzymes, insulin)

THE SYMBIOTIC INDUSTRIAL SYSTEM OF
KALUNDBORG, DENMARK

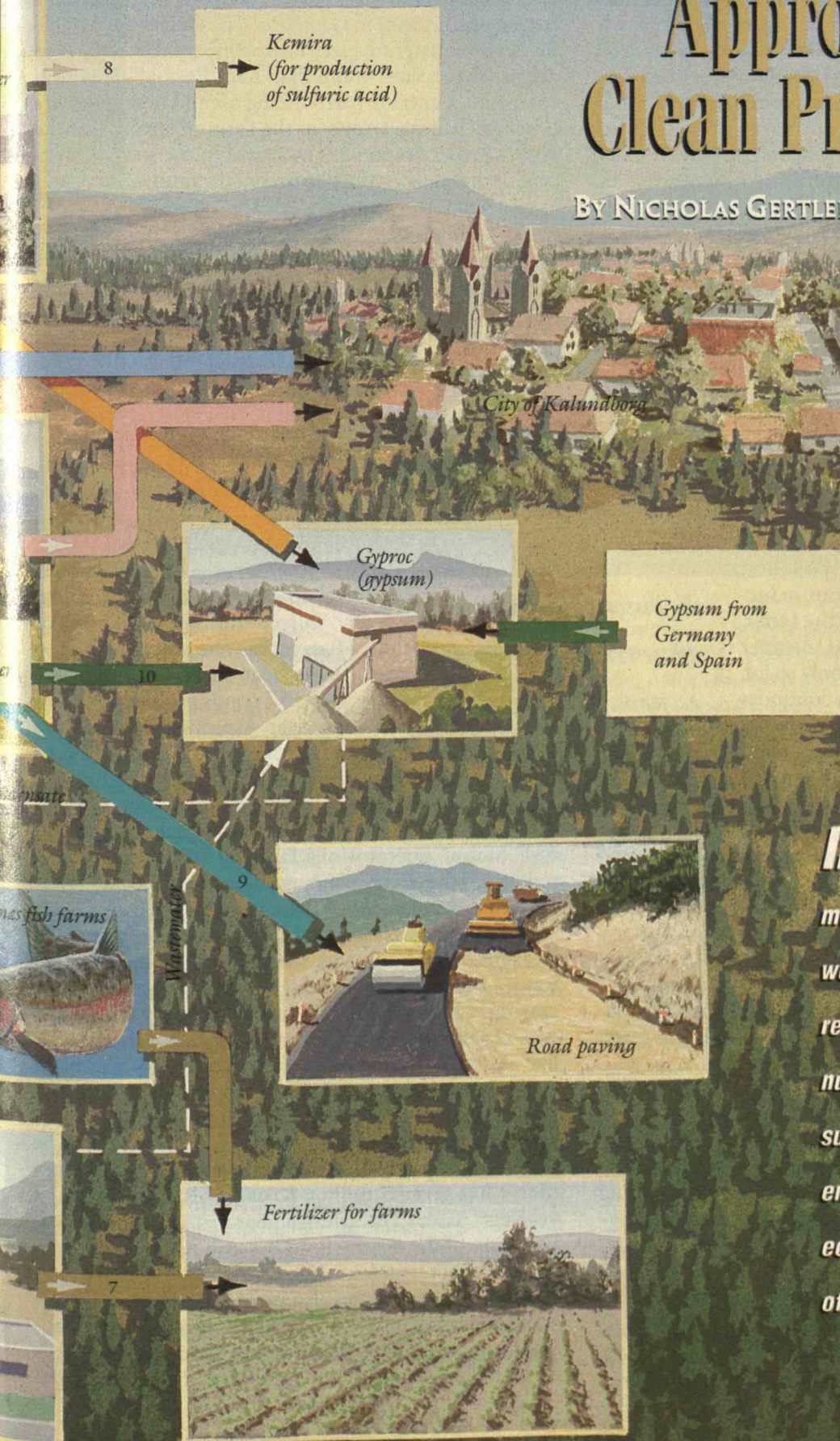
- | | | | |
|---|--------------------|----|---------|
| 1 | Water | 6 | Heat |
| 2 | Seawater | 7 | Sludge |
| 3 | Coal | 8 | Sulfur |
| 4 | Steam | 9 | Fly ash |
| 5 | Treated wastewater | 10 | Gypsum |

-----> Proposed exchanges

ILLUSTRATION BY JOHN MEGAHAN

A Down-to-Earth Approach to Clean Production

BY NICHOLAS GERTLER AND JOHN R. EHRENFELD



Industrial symbiosis, modeled on the natural world where organisms rely on each other for nutrients, promises to substantially cut the environmental—and economic—costs of manufacturing.

John Megahan
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FOR the past two to three decades, command-and-control regulations, which specify the kind of pollution-reduction equipment to use with each industrial process, have cut emissions from individual sources. But such accomplishments have come at substantial cost: efforts to control pollution absorb 2 to 3 percent of U.S. GDP. What's more, rising per capita resource use is rapidly eroding any gains, as exemplified by the growing number of U.S. vehicles and vehicle-miles traveled each year and the stubbornly high levels of urban smog that result. Sheer increases in the number of people, including an expected doubling of the world population over the next 40 years, further threaten to overwhelm efforts to cut pollution and resource use in both the United States and other countries, especially as the developing world attempts to reach Western levels of consumption.

Novel regulatory approaches to head off some of these problems are now in vogue, such as allowing companies to "trade" emissions and encouraging them to prevent waste in the first place. But the former simply spreads the pollution load more economically without reducing the overall burden while the latter, although certainly better and cheaper than treating effluents, can go only so far. For the most part the economy continues to operate as an open system, drawing raw materials from the environment and returning to it vast amounts of unused byproducts.

Fortunately, the emerging field of industrial ecology, which takes its cue from the closed loops inherent in natural ecosystems, offers a way to reduce the historically antagonistic tradeoff between economic activity and environmental health. The key to this approach is industrial symbiosis: like natural organisms that depend on each other for nutrients and absorb each other's waste, companies exchange byproducts for use as feedstocks rather than continually using virgin materials and discarding waste.

The most advanced example of this approach is the seaside Danish industrial town of Kalundborg, where a complex industrial symbiosis developed over the past 25 years as firms sought to make economical use of byproducts, partly to minimize the cost of complying with ever-stricter environmental regulations.

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How the Danes Do It

The heart of Kalundborg's industrial ecosystem is the coal-fired Asnæs Power Station, at 1,500 megawatts the largest power plant in Denmark. The efficiency of burning coal to generate electricity is inherently limited to about 40 percent—more than half the coal's chemical energy goes into the surrounding air and nearby bodies of water as heat, largely in the form of steam. But the Asnæs Power Station has managed to use some 90 percent of the energy available in coal by putting the plant's excess steam to work.

A network of underground pipes distributes the equivalent of 225,000 tons of steam per year to heat almost all of the town's 5,000 houses and buildings. Such district heating, common in northern climates, has reduced the town's oil consumption by 19,000 tons per year while sparing its air the sooty byproducts of oil-burning furnaces. Homeowners pay for the piping but receive cheap, reliable heat in return. According to Fleming Malkær of the Kalundborg Kommune, the town government, energy security was the main force driving the changeover to district heating, which occurred during the oil crisis of the mid-seventies. The power plant also uses excess heat to run its own fish farm, where 57 ponds produce 250 tons of fish per year. Asnæs sells sludge from the ponds—the solid waste produced by the fish—as fertilizer.

Asnæs delivers steam not only to homes but to its industrial neighbors as well. Statoil, operator of a large oil refinery across the road from the power plant, receives about 140,000 tons per year—40 percent of the amount it needs for heating pipes and tanks. Novo Nordisk, a manufacturer of pharmaceuticals and enzymes, receives some 215,000 tons of steam per year—all it requires for heat and processing. Novo decided to rely completely on Asnæs when faced with the need to upgrade its boilers in 1982; like Statoil, Novo expected steam from the power plant to be cheaper than a self-generated supply. A two-mile pipe, a prominent artifact of industrial symbiosis, runs along a main road to connect the three plants. The pipeline paid for itself in two years, and Novo estimates that it has saved 7 million Kroner (over \$1 million) a year ever since. The arrangement has also cut thermal pollution of the nearby fjord because Asnæs discharges much less hot water.

Asnæs Power Station also provides calcium sulfate—industrial gypsum—to Gyproc, a neighboring wall-board maker. The gypsum is a byproduct of Asnæs's \$115 million sulfur-dioxide scrubber, installed in 1993



Industrial ecology
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nistic tradeoff between
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- In Kalundborg, Denmark, home of
- an advanced form of industrial
- ecology, coal-burning Asnæs
- Power Station supplies 140,000
- tons of excess steam annually to
- nearby Statoil refinery and
- 215,000 tons to Novo Nordisk,
- manufacturer of pharmaceuticals.
- Asnæs also provides enough
- steam to heat most of the town's
- 5,000 houses and buildings. The
- power station in turn saves 30,000
- tons of coal each year (and
- reduces its carbon emissions) by
- burning light gas from Statoil that
- most refineries simply flare off.

in response to an agreement by Danish power stations to discharge less sulfur into the air. The agreement allowed utilities to choose the specific technology for cutting these emissions; Asnæs selected the scrubber largely because income from the sale covers most of the costs of operating the equipment. The scrubber produces some 85,000 tons per year of calcium sulfate, an amount that meets two-third's of Gyproc's needs. A similar German power plant supplies much of the rest. Gyproc formerly bought all its gypsum for a higher price from open-pit mines in Spain 2,500 miles away.

Asnæs power station also sells 200,000 tons of fly ash and clinker, residues of coal burning, for use in building roads and producing cement, thus forgoing the need to send the material to a landfill. This practice contrasts markedly with that in the United States, where coal-fired power plants rarely operate without a nearby disposal site for ash and sludge.

The Statoil refinery, producer of a range of petroleum products from light gas to heavy fuel oil, contributes its own byproducts to the area's symbiotic system. Many refineries burn off the mix of ethane and methane that is the lightest component of petroleum, but the eternal flame on Statoil's characteristic flare stack has been reduced to a pilot light. Since 1972, Statoil has been pumping the gas to Gyproc to fire the ovens that dry the wallboard. In fact, Gyproc obtains its entire supply of 900 kilograms per hour of gas this way, retaining a butane backup system for use when Statoil shuts down for maintenance.

Similarly, Statoil supplies flare gas to the Asnæs Power Plant. After modifying its boilers to accept the gas, Asnæs has been able to forego burning 30,000 tons of coal annually, saving money while cutting emissions of carbon dioxide, a greenhouse gas. Another source of savings, to Statoil, is the very process it uses to keep the gas "clean." Under community and regulatory pressure to reduce sulfur emissions, Statoil built a plant in 1990 to remove the sulfur from the gas it supplies. The desulfurization plant yields a hot, yellow liquid that is promptly shipped some 50 kilometers to Kemira, a producer of sulfuric acid.

Freshwater is scarce in Kalundborg, and accordingly the symbiosis partners have devised schemes for reusing water. Since 1987, Statoil has piped 700,000 cubic meters per year of cooling water to Asnæs, which purifies it and uses it as boiler feedwater. This reduces thermal pollution of the fjord into which Statoil had been releasing the warm water. Statoil also sends some 200,000 cubic meters of wastewater each year to Asnæs for use in cleaning industrial equipment. Community pressure and anticipated regulations compelled Statoil to invest in a facility for treating this water, making it clean enough for Asnæs' use. These operations have reduced water demand by the town's industries by 25 percent.

Meanwhile, Novo Nordisk, a world leader in producing insulin, enzymes, and penicillin, contributes to the community's symbiosis by finding uses for its own byproducts. Novo relies on genetically engineered



- The petrochemical companies
- that line the Houston Ship
- Channel have a long history
- of sharing byproducts through
- a network of pipelines. Such
- efforts remain rare in the
- United States, however,
- because federal regulations
- often leave little room for
- viewing waste as a potential
- resource, and because few
- firms are familiar with the
- inputs and outputs of near-
- by industrial enterprises.

microorganisms to convert food-grade material, mostly vegetables, into products using fermentation processes similar to brewing. What remains after the products are harvested is a nutrient-rich sludge with the appearance and consistency of light coffee. Since 1976, Novo Nordisk has been distributing NovoSlam—as this sludge has come to be called—through a network of pipelines to a thousand nearby farms, which spread it as fertilizer. The company uses steam from the Asnæs power plant to heat the sludge, which is free to farmers, to kill remaining microorganisms. Tanker trucks deliver the nutrients to areas not yet served by underground pipes, but the company is planning to extend the system. Novo's motivation has not been entirely altruistic; distributing NovoSlam as fertilizer was the least-cost way to comply with regulations imposed in 1976 that prohibited companies from discharging sludge into the sea.

Most visitors come to Kalundborg, which has lately become an ecotourist attraction, looking to discover the master plan behind these impressive efforts. But there is no such plan: participants have negotiated each link independently with the intensity and savvy of any other business deal. Valdemar Christensen, operations manager of Asnæs power station, says symbiotic cooperation is viable only if it makes economic sense, with each arrangement providing feedstock for less than the cost of virgin materials, or proving to be the least-cost way to comply with environmental regulations.

The Danish regulatory framework—more consultative, open, and flexible than its U.S. analog—is an important factor in encouraging these initiatives. Instead of putting firms on the defensive, county officials require businesses to enumerate options for continually reduc-

ing their environmental impact. Dialogues then ensue to establish which goals are worth pursuing—an approach that seems to encourage firms to focus on finding creative ways to become more environmentally benign rather than fighting regulators. Performance standards that state the degree of desired decrease in pollution, rather than technology standards that mandate a certain kind of equipment, are a key part of this approach.

The Danish experience also shows that successful industrial symbiosis requires a good fit among firms, as well as trust and what has been referred to in Kalundborg as a “short mental distance” among participants. Kalundborg's small size and relative isolation have made for a tight-knit community in which employees and managers of the four companies interact socially on a regular basis. Cultural pressures are similarly important: each firm strives for financial gain amid a backdrop with ever-stricter environmental regulations.

How the U.S. Could Do It

Although not as complex as in Kalundborg, U.S. examples of industrial symbiosis can be found. A Novo Nordisk plant in North Carolina produces the same nutrient-rich sludge, spread on 5,000 acres of farmland, as its Danish cousin. Coal-fired power plants in a number of states, including Texas and Florida, are supplying gypsum produced from scrubbers for use in wall-board; some peanut farmers also employ the gypsum as a soil additive. Wisconsin Public Service, a public utility, distributes the fly ash remaining after coal is burned for use in road building.

Full use of byproducts has a long history in the petro-

chemical industry, with the Houston Ship Channel an oft-cited example. Stretching for dozens of miles between Houston and the Gulf of Mexico, the channel is home to numerous chemical and energy-generating facilities that have been exchanging byproducts through a network of pipelines for decades. In a typical exchange, an Amoco plant routes vent gas (formerly flared) to a neighboring Chevron facility, which compresses and separates the gas into its hydrogen and propylene components and uses them as feedstocks for other industrial chemicals. Chevron pays for the gas, while Amoco complies with regulatory pressure from the state of Texas to reduce its emissions of air pollutants.

The success of these arrangements notwithstanding, U.S. examples of industrial symbiosis remain rare, not least because such efforts confront a regulatory climate that does not view waste as a potential resource. Regulations issued under the Resource Conservation and Recovery Act (RCRA) contain detailed requirements for managing an exhaustive list of waste streams, leaving little room for innovative reuse schemes like those in Houston (many of the substances that Ship Channel companies exchange are not considered hazardous, and some of the practices predate RCRA). This regulatory inflexibility stems largely from a deep-seated fear of sham efforts by companies attempting to avoid proper disposal of their waste.

Substances can avoid RCRA regulation by escaping the "waste" label, but attempts by the Environmental Protection Agency to articulate the distinction between wastes and resources are commonly held to form the most complex body of environmental regulations ever written—a strong deterrent to firms considering use of byproducts. State agencies may grant companies exemptions from the waste label for their byproducts but are reluctant to do so because EPA may deem the exemptions illegal.

Fortunately, RCRA as written does allow EPA to remove most of these barriers. The agency urgently needs to formulate clear guidelines that allow legitimate recycling and reuse on a case-by-case basis. Coupled with an acceptance by regulators of industrial symbiosis as a desirable goal, such a policy would go a long way toward encouraging the kind of byproduct reuse that the Houston Ship Channel shows is viable. Shifting the U.S. regulatory emphasis from technology standards to performance standards would also allow companies to explore creative solutions to controlling pollution.

To further encourage the development of industrial

symbiosis, policymakers must send businesses appropriate price signals. Taxes on pollution, waste disposal, and virgin materials—in contrast to now-common *subsidies* for raw materials—would create incentives for firms to account for their environmental impacts. If corporate income taxes were reduced in kind, pollution taxes would not only be revenue-neutral but would charge firms according to the extent of their environmental degradation rather than their profits.

Besides the right regulatory approach, industrial symbiosis requires companies to become familiar with the inputs and outputs of nearby enterprises—information that is often difficult to obtain. U.S. communities seldom duplicate the closeness of Kalundborg, and managers who don't know or trust one another are loath to enter arrangements that render their firms dependent on others.

A broker who explores and consumes symbiotic linkages can help break this impasse. VP Resources of Clearlake, Tex., plays such a role, which the firm describes as "finding a home for orphan chemicals." Proprietor Vance Purcell was an executive in the chemical industry before he found a niche developing secondary markets for byproducts—something that chemical companies have largely failed to do.

Some waste exchanges list available byproducts but VP Resources goes much further by finding appropriate uses for feedstocks, dealing with regulatory agencies, brokering agreements, and even transporting materials from generators to users. A key ingredient in VP's success is Purcell's ability to

convince state and federal regulators to allow exemptions for novel uses. For example, he convinced EPA to approve the sale of toluene—which his client had been injecting into deep wells and had tried to market as fuel, which EPA usually does not allow because of air pollution hazards—as a raw material for making paint. According to Purcell, the crucial step is assuring regulators that the companies will adhere to proper safeguards.

Bringing Developing Countries on Board

While still in its infancy in the United States, the notion of industrial symbiosis is receiving growing attention worldwide thanks in no small part to Belgian economist and entrepreneur Gunter Pauli. Pauli pushed the frontiers of corporate environmentalism as owner and CEO of Ecover, which markets environmentally benign cleansers manufactured in an "eco-factory." But Pauli found that however green Ecover's opera-

Although
*Kalundborg took 25
years to evolve, the next
generation of symbiotic
industrial communities
should arise much
more quickly.*





• A Wisconsin Public Service
 • plant in Oshkosh pipes in
 • methane from a nearby landfill
 • to burn in making electricity,
 • thereby reducing its need for
 • coal. The company is also
 • exploring the possibility of
 • burning crumb rubber from
 • discarded tires as boiler fuel.
 • To cut waste disposal, the
 • utility supplies the fly ash
 • residue from coal it does burn
 • for use in building roads.

tion became, it could only reduce waste, not eliminate it. Thus he relinquished the reins of Ecover to begin work on the Zero Emissions Research Initiative, or ZERI, in April of 1994.

Based at Tokyo's United Nations University, a clearinghouse for international research, ZERI seeks to improve the profitability of manufacturing while reducing its environmental impact by finding the "missing links" among multi-industry clusters of factories. The initiative's charter draws parallels between zero emissions and zero defects (total quality) and zero inventory (just-in-time manufacturing) by placing the no-waste concept squarely in the realm of corporate strategy. According to Pauli, "I see too many people who say 'very interesting, let's talk with the environmental people.' I say, no, you should talk with the strategic planning people."

ZERI is offering memberships to a select group of companies that would fund projects and receive priority access to research results in exchange. Companies and universities from over 20 countries have signed on, including Japanese engineering and machinery producer Ebara Corp. and the software firm ASCII.

Though ZERI's reach is worldwide, its primary focus has been on developing countries, particularly Africa. There pilot projects in Namibia, Tanzania, and Zambia are expanding the productivity of beer brewing, one of Africa's fastest-growing industries. The typical brewery consumes 10 liters of water per liter of beer produced in an area where water is scarce, and requires grains that must be imported. The brewing process extracts only 8 to 10 percent of the nutrients in these grains: the remaining cake is typically given away to farmers, an inefficient use for a

rich natural resource purchased at high cost.

The ZERI team has outlined a zero-waste alternative. The spent grain is approximately 70 percent fiber, which cannot be digested by animals but is prime feed for growing mushrooms. Most southern African nations import mushrooms, so producing them domestically would not only enable the countries to become self-sufficient but would provide a cash crop for export. Spent beer cake can also be used to fatten earthworms, which in turn can be used as chicken feed. Experience from China and Vietnam has further shown that spent grain and animal waste can be converted to biogas (essentially methane), an arrangement that supplies the giant Beijing Brewery with the energy to produce all its steam. Any remaining grain residues can be used as feed in breweries' deepwater fish ponds. Through this complex process, ZERI promises a sevenfold increase in the amount of nutrients available for human consumption and a fourfold increase in jobs—all on the basis of standard inputs to a beer brewery of cereals, yeast, and water.

These and other fledgling attempts to create symbiotic links show that it is possible to greatly reduce the flow of materials and energy into and out of an industrial system, thereby cutting pollution and easing the drain on natural resources. Thus, although "industry has the power to enhance or degrade the environment...[and] it invariably does both," as the Brundtland Commission on Sustainable Development put it, the balance can shift significantly toward the positive side of the ledger. Kalundborg evolved over 25 years. But now that we are learning more about the factors and forces that both push and impede this evolution, the next generation of symbiotic communities should not take nearly as long to arise. ■

HERE'S an idea. Perhaps if we avoid thinking about America's problems, stop doing research on them, and cease discussing them in public, they will magically disappear.

Sound like a promising approach? If you don't think so, you had better avert your eyes from the spectacle of willful ignorance gaining steam in Washington these days. Especially when it comes to policies that hope to guide the development and use of new technology, Congress has decided that less knowledge is definitely superior. As part of their quest to shrink the federal government and balance the budget, our legislators are moving to gut federal support for non-military scientific research. Spending for inquiry on socially sensitive issues such as global climate change, renewable energy, environmental cleanup, and consumer protection is being drastically cut. Also scheduled for downsizing or liquidation are several agencies—the National Institute of Occupational Safety and Health, for example—that have performed research related to important public needs.

One particularly lamentable casualty is the Office of Technology Assessment (OTA), an organization created a quarter-century ago to respond to a widely acknowledged need for bipartisan, high-quality advice on pending congressional legislation. Boarding up OTA saves the country all of \$22 million annually. But how many billions, I wonder, will be squandered in the coming years by legislators who lack the technical literacy OTA staffers have so patiently provided? One OTA study, for example, showed that the \$5 billion a year it would take to perform cholesterol screening on the elderly would have no net benefit.

The hinge that supports Washington's wildly swinging wrecking ball is a philosophy that denies there is an identifiable public good that can be served by carefully choosing avenues of technological development. Any guidance worth following must now come from the private sector. The idea that a nation might examine its problems and priorities, draw

Know-Nothing Technology Policy

Congress is throwing away its ability to guide R&D for the national good—a costly abdication of responsibility.



LANGDON WINNER

upon the best available evidence, and arrive at strong, common resolve is one that the ideologues who control Congress find utterly detestable.

Among the leaders of the backlash against R&D policy is Congressman Robert Walker (R-Pa.), chair of the House Committee on Science and a trusted lieutenant of Speaker Newt Gingrich. Walker has argued that "government is simply not capable of choosing" which technologies to develop. "Programs that attempt to pick winners and losers" among technologies, he said, "amount to little more than corporate welfare."

But Walker's position is disingenuous. Every dollar voted in the federal budget represents someone's idea of causes that ought to be "winners" in society, whether those be school lunches or Apache

helicopters. And although an avowed foe of what he calls "boondoggles" in Department of Energy spending, Walker nevertheless pushes his own pet projects in hydrogen R&D, where funding will jump 50 percent. And the Republicans' blustery talk about not picking winners evaporates when it comes to the Pentagon. Congress has increased the defense budget \$9 billion over President Clinton's request—awarding new funding for the fantasy-ridden Star Wars program and for the hapless B-2 bomber, which (according to the General Accounting Office) features high-tech radar that has trouble telling a rain cloud from a mountainside.

As one consequence of the new mood of policy indifference, public discussion about technological choices will markedly deteriorate. Fewer will be the arenas in which democratic process and expert understanding will intersect in search of common goals. Less frequent will be opportunities for open, critical debate about which paths of technological change are in the national interest. Key decisions will be left to the board rooms of transnational firms, deliberating away from the light of public scrutiny. As the standard of living for many Americans erodes, it grows painfully obvious that profit-motivated innovation alone will do little to address a host of unsolved social problems. Yet the nation's ability to adapt and respond will be feeble, because such topics have been removed from the political agenda.

In Herman Melville's *Moby Dick*, there comes a moment when mad Captain Ahab rebels at navigation, smashing his quadrant on the deck of the *Pequod*. From now on, he announces, he will pursue the great white whale with "dead reckoning" alone. The flurry of destructive choices from Congress these days echoes Ahab's delirium. Faced with stormy seas and enormous dangers ahead, our leaders have opted for instinct over intelligence. ■

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THANKS to an unparalleled body of domestic legislation and international treaties, environmental conditions have, by almost any measure, improved greatly over the past 25 years. Cities have cleaner air; rivers are less polluted; health-threatening toxic substances have been identified and some eliminated; endangered and threatened species have been protected.

This epoch of enlightenment may be ending, however, as the 104th Congress mounts the strongest attempt to undermine environmental protection since the publication of Rachel Carson's *Silent Spring* in 1962. The Republicans who control Congress claim that they want only to trim regulatory excesses. But the extent of their assault adds up to much more. Lawmakers want to slash R&D on renewable energy technologies such as photovoltaics and biomass. Funding for research on global climate change will likely suffer a similar fate. The environmental technology programs of the Environmental Protection Agency are candidates for large cuts or elimination.

The zeal to weaken environmental laws and regulations feeds on the perception that legal mandates intended to protect the environment have imposed economic or social penalties that outweigh the environmental benefits. In the northwestern United States, for example, the protection of old-growth forests that provide a habitat for the endangered spotted owl conflicts with the local economic base. The clash over wetlands pits developers and defenders of personal property rights against those concerned with the loss of ecosystem viability. Depleted fish stocks along the East Coast have spurred the federal government to strictly limit commercial fishing, at the expense of the fishing industry.

Where the clash of values becomes most palpable is in the treatment of the Department of the Interior. Congress is now pushing, over the strong resistance of Secretary of the Interior Bruce Babbitt, actions to open the Arctic Wildlife Refuge in northernmost Alaska to oil and gas exploration, thus exposing this pristine wilderness to the danger of great

The Environmental Backslide

*Past mistakes and
excesses hardly justify
Congress's meat cleaver
attack on environmental
safeguards.*



ROBERT M. WHITE

ecological damage. Congressional leaders also want to revert to the century-old laws governing the mining of public lands—thus providing a bonanza of mineral rewards for the pittance required of mining companies filing claims. To add injury to injury, Congress seeks to impose a moratorium on the further listing of endangered species.

Environmental policy does contain some irrationality. The National Environmental Policy Act, for example, has on occasion been used as a device to unnecessarily delay economic development. Congress had to override the provisions of that act, for example, to enable construction of the Alaska oil pipeline—which, after almost 20 years of operation, has caused no serious environmental problems. Some environmental laws have had unintended consequences. The Magnuson Fisheries Management and Conservation Act, for example, was supposed to exclude foreign overfishing in U.S. waters. But the regional fisheries councils that this law created have been populated by the fish-

ing industry, which has thwarted the ability to maintain sustainable fish stocks.

Furthermore, environmental laws and regulations are not perfect and must continually take into account changing technology and new scientific knowledge. And when possible, it is both more effective and more palatable to use market incentives, rather than federal mandates, to achieve environmental goals. Further fine-tuning is thus certainly in order, but the mass demolition in which Congress is now engaged amounts to a tragic overreaction.

Fortunately, President Clinton has taken a strong stand, threatening to veto any budget bill that strips away needed environmental protections. The actions of environmental groups, along with sympathetic articles in the news media, have stimulated deep public concern. Faced with public anger at their perceived indifference or antagonism toward clean air and water, politicians will be forced to reconsider their course of action.

But such political backfires are at best a short-term tactic. Erecting a more enduring bulwark against the environmentally destructive aspects of the present political mood will require that defenders of environmental policies introduce into the debate credible scientific assessments. Studies issued by the National Academies of Sciences and Engineering and the Institute of Medicine, for example, have already shown the basic scientific soundness of the Endangered Species Act and of wetlands legislation.

Over time, the present controversies may serve the environmental movement well by making it more sensitive to other social values. But such sensitivity entails careful and thoughtful analysis of trade-offs—not the radical underprotection that is now being offered as a substitute for what a few have perceived as radical overprotection. ■

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Scientists Must Join the Fray

AMONG the wonders of the budgetary bloodbath in Washington is the feeble, delusional response of one of its prime victims, the American scientific and technological enterprise, in both academe and industry.

While other targets of political parsimony and ideology are hitting back with the traditional weapons of politics—campaign money and other help for friends and electoral retribution for opponents—the research community sticks to its traditionally conciliatory formula for coping with difficulties in Washington. This consists of sermonizing the faithful, at meetings and in professional journals, and issuing temperate, public declarations of the importance of scientific research for national well-being, in the misapprehension that politics is moved by earnest petitions and reasoned reports.

As usual within science, there's also a strong streak of unsubstantiated belief that the poor state of scientific literacy in America contributes to the political misfortunes of research. Thus, we hear exhortations for more and better scientific education to gain support for



If researchers hope to convince Congress to back off on cutting federal R&D support, they need to abandon their dainty opposition and employ the combative political tactics of groups such as the National Rifle Association and the Christian Coalition.

BY DANIEL S. GREENBERG

research programs, as if R&D budgets have ever reflected public comprehension of, say, chemistry or mathematics. Spike these ingredients with a strong dose of denial about what's really going on in Washington, and the chieftains of research emerge as a modern-day version of the cargo cultists—religious fanatics who believed that material wealth could be obtained through ritual worship.

Compared with most other federal dependencies, these scientists point out, research has fared relatively well in this difficult time. Yes, federal support for R&D stopped growing several years ago, and has now started to recede. But the downturns, they optimistically conclude, were mainly caused by the end of the Cold War and by the imperatives of deficit reduction, not by hostility to science. We have many warm supporters on Capitol Hill, the mandarins of research proudly observe. After all, the chair of the House Science Committee, Rep. Robert Walker (R-Pa.), describes himself and

his close friend, Speaker Gingrich, as “techno-nuts,” and they both express enthusiasm for basic research.

Realities of the Revolution

Now, let's step back from this immobilizing trance, and examine the political realities of science and government today. With strategic clarity, the Republican Revolution has opened two fronts against the research enterprise—economic and intellectual.

First, and most conspicuously, it is committed to massive reductions in government finance for science and technology. Entire sectors of federal R&D support have been slated for elimination, particularly in the industrial area, which has been cut by about \$1 billion from last year. Even biomedical research, long the darling of Congress, is slumping in real terms. Support for basic research is going down, too. But the first step was small, just a percentage point or two in real terms, thus contributing to complacency among scientists. However, the Republican long-term spending plan calls for a one-third reduction in civilian R&D spending, including basic research, by the year 2002.

The techno-nuts have not renounced their budget-cutting plans. They continue to justify it with voodoo assurances that deficit-reduction will invigorate the economy and bring in a gusher of private money to compensate for reductions in federal research spending. Though that happy possibility cannot be ruled out, the record of the past 30 years shows a fairly consistent relationship between federal and industrial R&D spending. With a time lag of about one year, private money has followed the ups and downs of public money.

Second, using their fiscal strength and their powers of intimidation over the timorous federal research bureaucracy, the Republican majorities in Congress have moved vigorously to restrict the intellectual independence of scientific research and public-policy analysis. Since money is the measure of reality in Washington, these thrusts have not always received the attention they deserve, but they are as

much a threat to the vitality of research as a cutoff at the treasury. Consider a sampling in this category:

■ The congressional Office of Technology Assessment, an oasis of independent, honored scholarship on Capitol Hill, has been abolished—ostensibly to save \$22 million in a congressional housekeeping and operations budget that totals \$1.7 billion.

■ The House Appropriations Committee has directed the National Cancer Institute to terminate support for a study at the University of California of the influence of tobacco-industry campaign contributions on state programs to discourage smoking.

■ Ten senators, led by Majority Leader Robert Dole, have protested the Centers for Disease Control and Prevention's support for university-based studies of firearms injuries, which account for 37,000 deaths a year. The studies, the senators said, are hostile to legitimate gun ownership.

■ Within the Public Health Service, the Agency for Health Care Policy and Research, which sponsors studies of the outcomes of medical therapies, has lost a major part of its budget. Among its severest critics were orthopedic surgeons enraged by the agency's findings that cast doubt on the superiority of surgery for back pain. Other specialties griped, too, when their treatment methods were found lacking. Objective research on the myths and realities of medical treatment offend some representatives. They responded where it counts—in the budget.

■ In fulfillment of pledges to reduce the presence of government in American life, wholesale budgetary mayhem has been inflicted on environmental agencies. Created in 1993 to put scientific rigor into studies of endangered species, the National Biological Service, an agency at the Department of the Interior, has been marked for abolition by legislators who fear that it might identify more endangered species.

■ And then there's the Republican assault on research that led to detection of the so-called ozone hole and the ensuing international restrictions on the chemical culprit, Freon, and other refrigerants containing chlorofluorocarbons (CFCs). Cit-

ing the heavy costs of developing replacements for CFCs, the House majority whip, Rep. Tom DeLay of Texas, has introduced legislation to repeal the CFC phaseout. "The ban is the result of a media scare," he told a House hearing in September. The author of another antiphaseout bill, Rep. John T. Doolittle (R-Calif.), discounting the extensive peer review of the CFC-ozone data,

*An exemplar of
political muscle power
is the American
Medical Association.
Regularly a major
contributor to political
campaign funds, the
AMA has long been
assured a place at the
table when Congress
legislates on health.*

said, "I'm not going to get involved in peer-review mumbo-jumbo." The hearing, chaired by California Rep. Dana Rohrabacher, was titled "Stratospheric Ozone: Myths and Realities," and was part of a broad inquiry by Rohrabacher that goes under the heading "Scientific Integrity and Public Trust: The Science Behind Federal Policies and Mandates." Rohrabacher, who chairs the Science Committee's Energy and Envi-

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ronment Subcommittee, says the science underlying federal environmental policies lack integrity and does not warrant public trust.

Money Talks

By attacking research at its two most vulnerable points—money and intellectual freedom—politics today is becoming

addressing its concerns to the president, Speaker Gingrich, and Senate Majority Leader Dole. A 25-member contingent of Nobel laureates has weighed in with a plea for generous support of research, as has a group of high-tech industrial CEOs. Papers trumpeting the bountiful return from federal investments in research have been issued by the White House Office of Science and Technology Policy and the

strength, as quantified in campaign money and other means of mobilizing mass voting power.

Of course, as nonprofit organizations, scientific societies are precluded from making political contributions. But there's nothing to prevent scientists from organizing political action committees to raise money and mobilize support for candidates who recognize the importance of scientific research. Though science refuses to play that game—scholars deem it inappropriate to buy favor in politics—others who are not so finicky are quite successful in securing political attention. They understand a basic rule of American political life: campaign contributions can't guarantee results, but, given the ravenous financial requirements of modern politics, money usually provides access and attention, which are the first steps toward results. Members of Congress and staff are, of course, courteous to visitors, especially constituents. But they tend to be extremely hospitable and attentive to visitors associated with sizable campaign contributions and voter influence.

An exemplar of political muscle power is the American Medical Association. Regularly a major contributor to political campaign funds, the AMA has long been assured a place at the table when Congress legislates on health. As noted in *The Serpent and the Staff: The Unhealthy Politics of the American Medical Association*, by Howard Wolinsky and Tom Brune (G.P. Putnam's Sons, 1994), the AMA, through its American Medical Political Action Committee, "remains the premier practitioner of the art and science of medical politics." No other group in health care, the authors correctly state, "can touch the AMA in terms of influence or access to power brokers." When the Medicare rules were being rewritten during last fall's budget deliberations, even though the AMA didn't get all it sought, legislators carefully considered the AMA's preferences on doctors' fees and other heartfelt matters.



especially lethal. The combination, and the extraordinary danger it poses to the research enterprise, would seem to call for an extraordinary response. But nothing has changed. Oh, yes, a tepid statement advising caution in reducing research budgets has been issued by the National Science Board at the National Science Foundation. The President's Committee of Advisors for Science and Technology issued a similar statement,

Council of Economic Advisers. Scientist-constituents have visited congressional offices to urge support for research.

Having fared well in the past with such prose barrages, particularly during pro-spending Democratic Congresses, the science establishment cannot comprehend that the new lords of Capitol Hill are not driven by the old ideology and are immune to mere petitions. They do pay attention, however, to raw political

Similarly, the close attention politicians accord the preferences of the National Rifle Association is not attributable to the cogency of the NRA's positions. Rather, the NRA is renowned for backing its political friends and bashing its political enemies with money, campaign assistance, and votes.

A long list of corporate contributions in the first half of 1995 to Republican Party committees—so-called soft money, permitted in unlimited amounts—shows three big tobacco companies at the top, for a total of \$1,276,199. Tobacco faces many difficulties. But money keeps the doors open in Congress.

Reward and Punishment

Given the fiscal and intellectual bashing that science is taking on Capitol Hill, there is no justification for the research enterprise persisting in its traditionally dainty approach to the political system on which it depends. Scientists must recognize that friends in that system merit help, while the indifferent and unfriendly should be strongly proselytized or chastised.

At present, the friends of science are rarely rewarded with what counts in politics—money and votes. The exceptions are few and minor. In 1992, a committee of prominent scientists raised some \$40,000 for the campaign of Rep. George Brown (D-Calif.), then chair of what is now called the House Science Committee. The formation of the "Friends of George Brown" was a most unusual occurrence, and may have been related to Brown's wry observation that scientists were always coming to see him, except at election time.

While neglecting to help their friends, scientists also refrain from the time-honored electoral practice of punishing one's enemies. Consider, for example, the abolition of the Office of Technology Assessment. OTA was a center of scholarship embedded in the legislative process. PhD scientists and engineers were heavily represented on its staff, and the work of OTA involved close relations with researchers in academia, industry, and government. The destruction of OTA was as rank a piece of political vandalism as has ever been committed on Cap-

itol Hill. But the perpetrators, led by Sen. Connie Mack (R-Fla.), remain unscathed, as do others who have damaged the research enterprise.

Science is among the very few sectors of society that remains aloof from the



Given the new political system in Washington, scientists must recognize that friends in government should be rewarded with the only thing that counts—money and votes—while those antagonistic to the cause should be punished.

customary political process of organized support for friends and punishment for enemies. Pro-life advocates know the power of money and votes, as does the NRA, which helped topple the last speaker of the House, Tom Foley, in retribution for his support of gun-control provisions in a crime bill.

The new politics in Washington demands a new politics in science, a departure from passivity and naive faith in goodwill. At the minimal level of political response, it would be useful for the scientific community to identify its friends in the mists of strife on Capitol Hill. Given the complexities and duplicities of

committee and floor procedures and the density of legislative texts, scorekeeping is far from simple. But it is doable.

Many politically interested groups, ranging from the American Civil Liberties Union to the National Tax-Limitation Committee, rank members of Congress on how they vote on key issues. But no one in the research community maintains such a ranking. The costs of tracking the friends and grave diggers of science could be shared by academic and research organizations that maintain a presence in Washington to look after their particular interests.

Rep. Brown urges scientists and other academics to develop relationships with their representatives, to hold candidate forums on campus at election time, and so forth. But he stops short of recommending a full-fledged plunge into political warfare.

A scenario for such bare-knuckles political involvement was described at a meeting last summer on the oncoming budget crunch, sponsored by the American Association for the Advancement of Science. Addressing the dour assemblage that had hurried to Washington for an assessment of Republican budget plans was William G. Wells, Jr., associate professor of management science at George Washington University. Wells is also a consultant to the White House Office of Science and Technology Policy. "So what to do?" asked Wells, and he proceeded to inventory the possibilities, ranging from traditional informational lobbying to the development of "a coherent alliance among yourselves."

As a model for the latter, he urged attention to existing examples, particularly the Christian Coalition. "With only 1.6 million members," he said, "but a budget of \$25 million (an average of \$15 per member) and the leadership of an astute executive director, Ralph Reed, the coalition has become one of the most potent political forces in the nation—with easy access to political powers at the national and state levels."

Noting that the coalition's Washington office is "supported by hordes of volunteers who can be activated and energized on short notice," Wells added, "presidential candidates seek access to the coalition and Reed's advice—not about reli-

gion but about politics. By contrast, and for the most part, the science and technology worlds are not even a blip on politicians' radar screens."

Wells's strong formulation evoked little response from the assembled researchers, who groused indignantly about impending budget reductions and returned home, no more politically engaged than before they came to Washington.

People concerned about abortion and other issues relating to "family values" are strongly energized by politics, as are other members of the electorate. Perhaps because of the easy and beneficial relations they enjoyed with government throughout the postwar period, scientists remain aloof from politics. But they must understand the need to change—and do it soon. ■

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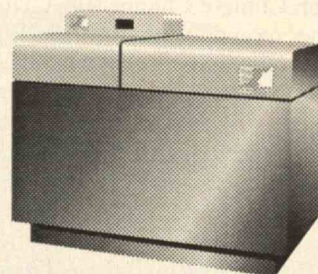
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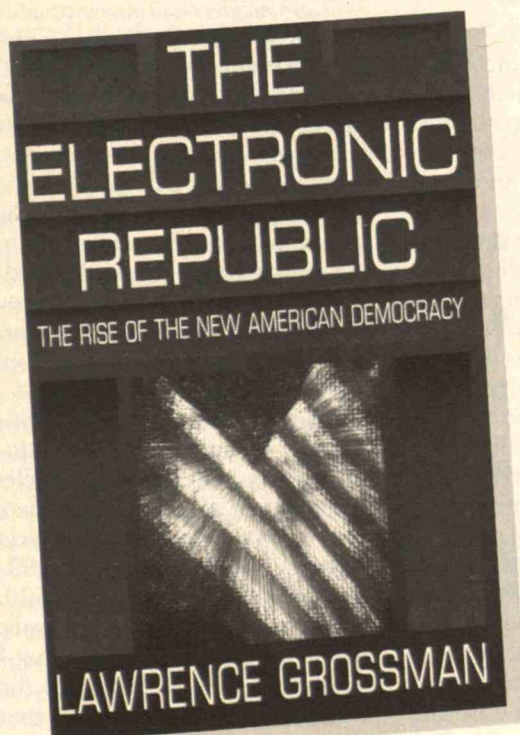


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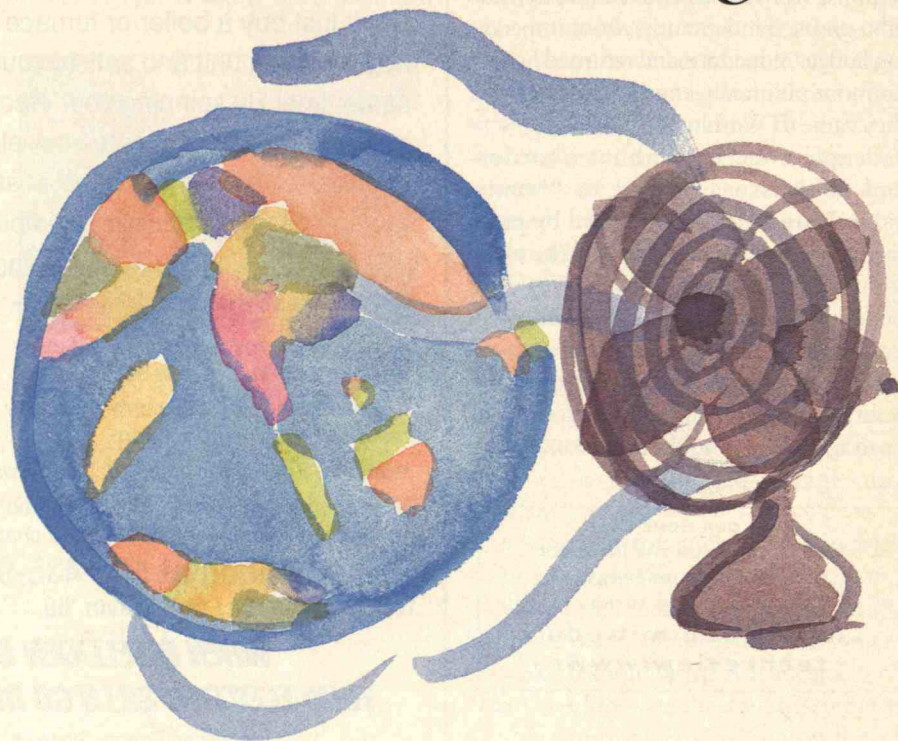
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AFTER a brief hiatus during which the eruption of Mt. Pinatubo cast its cooling shadow, global warming is back. It is not only back as a physical entity—raising the global average temperature to half a degree Celsius above the 1950–1980 mean during the first seven months of 1995—it is back as a front-page issue. The Intergovernmental Panel on Climate Change (IPCC) made headlines recently when it concluded for the first time that the warming already observed in this century is likely to be at least in part the result of human activity.

The reemergence of this issue finds U.S. policy toward climate change in disarray. The Clinton administration has proposed measures to begin fulfilling the 1992 Rio de Janeiro Climate Treaty—the basic goal of which is to stabilize greenhouse gases at a “safe” level—yet Congress is systematically slashing funding for both climate change research and emission reduction programs. While these pitched battles are being fought over the piecemeal proposals that have so far been put forward, the fundamental problem is a failure to establish incentives for promoting the kind of responsible energy use that will cut the amount of carbon dioxide being pumped into the atmosphere. And indeed it is apparent that neither side in this largely partisan debate has really gotten the incentives right. Only when all sectors of the economy have a clear motivation to burn less coal and oil will the United States be able to do its part to stem CO₂ emissions.

Energy efficiency is one area where incentives need adjusting. Studies from sources as diverse as the industry-sponsored Electric Power Research Institute and Amory Lovins’s Rocky Mountain Institute suggest that it is possible to at least double the energy efficiency of the U.S. economy with investments that pay for themselves. But contrary to the assertions of some congressional leaders, these improvements will not automatically occur if the economy is left to its own devices. Thanks to the legacy of lavish energy subsidies, such as generous tax breaks for oil exploration, combined with misplaced incentives on the de-



Stronger incentives for responsible energy use could help lower CO₂ emissions to safe levels.

mand side—exemplified by inefficient appliances selected by contractors concerned with minimizing first cost rather than life-cycle cost—the U.S. economy systematically underinvests in energy efficiency.

But if free markets don’t ensure efficient energy use, neither do all the proposals held out by the Clinton administration. Take transportation. The administration’s main effort is the Partnership for a New Generation of Vehicles, a cooperative research and development program between the Big Three U.S. automakers and the federal government. Its primary goal is to produce by 2003 a prototype vehicle that offers up to three times the fuel economy of conventional vehicles while maintaining price, size, and performance similar to today’s Ford Taurus sedan. A likely technology is the hybrid-electric drive, which combines a small, high-efficiency

gasoline engine with electric motors.

The problem with this program is that the automakers have made no commitment to mass-produce the vehicles. Will any manufacturer risk the billions of dollars that would be needed to tool up full production in the face of uncertain costs and unknown consumer demand for a new type of car? Uncertainty about the market could subside if consumers had a stronger incentive to care about fuel efficiency.

While excess fuel consumption is costly to the environment and to society, even in conventional vehicles fuel expenditures are a small portion of the costs of owning and operating a car. For example, a vehicle driven 10,000 miles per year with a fuel economy of 20 miles per gallon uses only \$600 of gasoline per year at the current price of about \$1.20 per gallon. One study found that the average cost of driving is 46 cents per

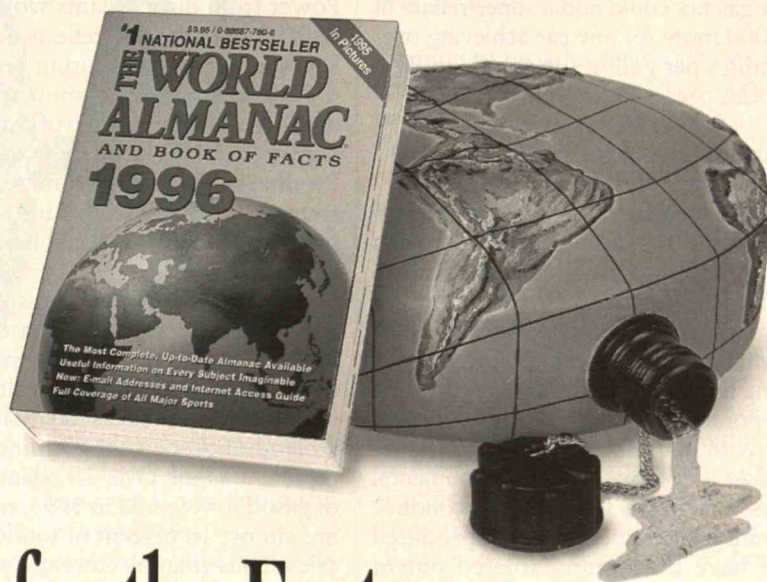
mile, of which only 5.2 cents is for gasoline and motor oil.

Thus, suppose a manufacturer believes it can sell superefficient (60-mpg) cars at a price that is 10 to 20 percent higher than that of conventional vehicles. While the annual fuel saving would be \$400, the increase in the sticker price would be about \$1,500 to \$3,000. At the low end of this range, consumers would recoup the added up-front costs in four or five years, and manufacturers might expect reasonable, though not overwhelming, sales. At the upper end of this range, the payback time stretches to an unrealistic eight years. Nonetheless, even with a 20 percent price premium, such vehicles would represent an extremely cost-effective way for society as a whole to reduce greenhouse gas emissions, because the added up-front costs are eventually recovered through fuel savings. (Indeed the rate of return is still quite attractive in comparison to, say, Treasury bonds, but consumers generally don't view car purchases in this light.)

How can we ensure that hybrid-electric or comparable vehicles actually make it onto the road and that, in the meantime, conventional vehicles become more efficient? The answer given by many economists and the automakers is hefty gasoline tax hikes. However desirable this approach might be in theory, an exclusive focus on gasoline taxes is a political dead-end; perceived disparities in the way the tax would affect different regions and income classes, along with fierce lobbying by the oil industry, make European-style gasoline taxes virtually unimaginable here. What's more, gasoline taxes are a relatively weak lever for getting new technology onto the road. In the above example, even a 50-cent rise in the gasoline tax would cut the payback time by only a couple of years.

An alternative approach would be to provide rebates on the sale of efficient vehicles. This would lower the upfront cost to consumers and give manufacturers the certainty they need to make investments in new technology. Monies for rebates could come from fees on vehicles that are less efficient than aver-

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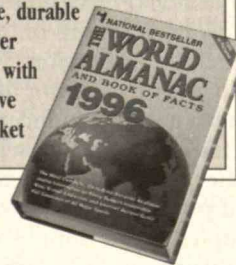
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age, perhaps combined with a very small gasoline tax. For example, a sliding-scale fee that reached \$1,000 per car posting only 21 miles per gallon could fund rebates that reached \$1,000 for cars achieving 40 miles per gallon and \$2,300 at 80 miles per gallon. A one-cent gas tax could add a super-rebate of \$1,000 more for any car achieving over 60 miles per gallon (up to one million vehicles per year).

Spurring Alternative Energy

Better incentives are also needed to encourage the development of clean technologies for producing electricity—both to ensure that their environmental advantages are recognized in the marketplace, and to help them advance along manufacturing learning curves to the point where they are fully competitive with mature coal and oil technologies. As long as we ignore environmental costs, coal plants will have an economic advantage: they are fully depreciated and have been grandfathered out of many current environmental requirements. Such plants can often generate electricity at operating costs of only a few cents per kilowatt-hour. Thus, even low-cost renewable resources, such as highly efficient variable-speed wind turbines that can be brought on line for less than 5 cents per kilowatt-hour in many areas, will have a hard time competing. Solar cells face a similar future, even though their cost has fallen dramatically in the last 15 years.

One potentially helpful development is that the Federal Energy Regulatory Commission (FERC) appears to be moving toward a system of "open-access" electricity transmission. This approach would make it easier for utilities or independent power producers in a region with excess capacity to sell electricity to another region that needs the power. Wind power from North Dakota, for example, could supply electricity to Minneapolis and Chicago, or solar electricity from Nevada could supply Texas. But a less benign possibility is that underutilized coal capacity in the Ohio

Valley could displace cleaner but more expensive gas-fired power along the eastern seaboard.

This is where proper incentives come in. FERC could apply an environmental surcharge when deciding whether a proposed power sale is truly cost-effective. Power from dirtier plants would come with a surcharge that reflects their environmental cost, preventing generators that do not meet environmental standards from gaining an artificial advantage in the new electricity marketplace. Producers of power from renewable sources, meanwhile, would receive a boost in demand that could fund further gains in efficiency.

Alternative fuels for transportation are another promising climate-change remedy that suffers from skewed incentives. The most widely used alternative fuel in the United States today is gasohol, a blend of 90 percent gasoline and 10 percent ethanol. Over 10 billion gallons of gasohol were sold in 1993, representing almost 10 percent of total gasoline sales. Thus ethanol, currently produced from corn, now provides about 1 percent of the automotive fuel supply. The federal government provides corn growers and processors with large subsidies, in the form of a tax exemption of 5.4 cents per gallon of gasohol (or 54 cents per gallon of ethanol) to make corn ethanol profitable. But while advocates portray ethanol as a renewable energy source, corn ethanol requires so much fossil fuel for fertilizers, tractors, and processing that the net impact ranges from only a slight decrease to an actual net increase in carbon dioxide emissions.

Recent developments in biotechnology, however, have the potential to transform ethanol production into a clear environmental winner. A program at the National Renewable Energy Laboratory in Colorado has engineered new enzymes and yeasts that can break down and ferment woody crops and wastes, rather than just high-quality starches like corn, as is the case today. Because this process can use more of the plant material, and because growing woody crops requires much lower levels of chemicals than

growing annual crops, cellulosic ethanol can be produced with 80 percent smaller net emissions than conventional gasoline and corn ethanol. This technology is now being tested at the pilot plant scale, but it could require 10 to 20 years to become competitive with petroleum.

To give cellulosic ethanol a fighting chance, existing subsidies for corn ethanol would have to be replaced with market incentives that reward alternative fuels according to how much they help reduce greenhouse gas emissions. The existing ethanol subsidy costs the U.S. Treasury about \$700 million per year, and the amount is growing. These funds could be put into a pool—capped at a total of, say, \$1 billion per year—that would be available to alternative fuel providers according to the net reduction in greenhouse gas emissions they achieved. This would give the industry a strong incentive to improve its environmental performance and shift to cellulosic feedstocks. The cap on total payments would ensure that the Treasury did not have an open-ended liability: the incentive payment per unit of fuel would automatically fall as the technology matured and production volumes grew.

Such proposals of course do not constitute a comprehensive strategy for stabilizing atmospheric CO₂; they merely give a flavor of the kind of rethinking that will be required of government. While such rethinking is not politically easy, the effects of a warming climate could provide policymakers with the motivation needed to overcome the inertia of the current perverse incentive structures. If the president and Congress are truly interested in market-based solutions to environmental problems, this would be an excellent place to start. Each new global temperature record will raise the question, How much does the climate have to change before we bring market incentives into line with environmental goals? ■

DANIEL A. LASHOF is a senior scientist at the Natural Resources Defense Council in Washington, D.C., and a former staff member of the U.S. Environmental Protection Agency.

Reviews

BOOKS

STATISTICALLY INSIGNIFICANT

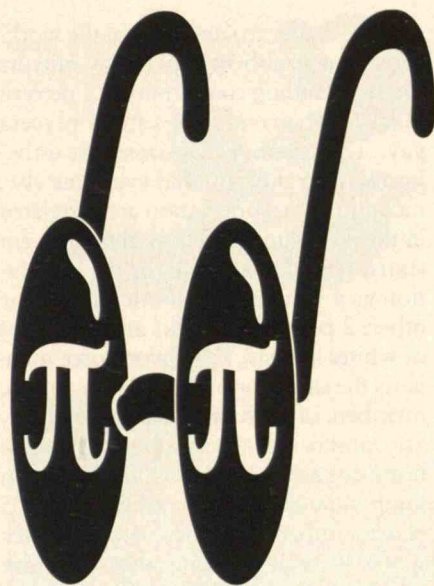
A Mathematician Reads the Newspaper

by John Allen Paulos
Basic Books, \$18.00

BY ARNOLD BARNETT

A *MATHEMATICIAN Reads the Newspaper* by popular author John Allen Paulos (who also wrote the best-seller *Innumeracy*) has surprisingly little to do with newspapers per se. It seldom discusses particular publications and specific stories; mainly, it explores potential links between mathematical concepts and developments generally reported on in television programs, magazines, and books as well as in newspapers. More troubling, the book is not the work of a typical mathematician. Mathematics is famed for the precision of its definitions, and its clear distinctions between what can be established and what is merely conjectural. Yet this volume is a potpourri of vague concepts, incomplete arguments, and statements that are unsupported if not intrinsically unsupportable.

For example, consider Paulos' thoughts on the "halo effect," which he describes as "the tendency to judge a person or group in terms of one salient characteristic." The phenomenon confers undeserved advantages on its beneficiaries, he informs us, and it "partially explains" why so many experts on the late-night news program "Nightline" are identified with Harvard or Yale. How could Paulos have defended this assertion? It would not have been enough to show that a disproportionate fraction of "Nightline" guests are from Harvard or Yale; these schools, after all, try to fill their ranks with the best thinkers in the world. Rather, Paulos would have had to supply repeated examples in which



"Nightline" host Ted Koppel interviewed a Harvard or Yale guest when someone with a lesser pedigree would have been clearer and more insightful. He supplies zero examples.

Similarly problematic is the book's discussion of "availability bias," under which people evaluate new experiences in light of others that first come to mind instead of those that are most relevant. Paulos sees the process at work when American officials approach the situation in Bosnia by speaking of the "tenuously related epoch" of Vietnam. Doubtless he is correct in saying that when Americans contemplate Bosnia, they think more about the war in Vietnam than the one in Peloponnisos. But to make his point about bias, he must show that the analogy between Bosnia and Vietnam is superficial and unhelpful. This he does not do.

Moreover, Paulos' frequent remarks about the lack of balance in public perspectives are not always cogent. Why, he wonders, do heroin and cocaine "have more emotional impact and induce more alarm" than cigarettes or liquor, when the first two kill 14,000 Americans a year while the last two kill half a million? The answer, perhaps, is that, rightly or wrongly, we fear that users may try to burglarize, injure, rob, or kill us in the

course of supporting their habits. If we are concerned about the risks to ourselves as well as those to addicts, then the statistics Paulos cites hardly illustrate a public tendency to "misjudge the real hazard."

Who Benefits?

Turning to broader issues, Paulos sees economic forecasting models as doomed to fail because in a chaotic world, the "inevitable amplification of tiny differences" helps make the economy "almost invulnerable to dependable forecast." This argument might have been strong had he offered some definition of a successful economic forecast, and perhaps even some evidence that forecasts rarely succeed. But he opts instead to free associate on the subject of tiny differences. As an example of such a difference, he points to the job candidate who shocked an interviewer with an apparent boast that his grandmother had posed for *Peep Hole* magazine. Only after rejecting him did the interviewer realize that he had said *People* magazine. An amusing anecdote, to be sure, but it is odd to see it invoked to suggest the futility of economic modeling.

Even the book's relatively detailed analyses are not satisfying. In one such analysis—which was acclaimed in the pages of the *New York Times Magazine*—Paulos aims to debunk some of the more widely accepted commentary on the 1993 New York City mayoral election, in which the white Republican Rudolph Giuliani defeated the black Democrat David Dinkins. Responding to charges that the outcome was a spectacle of white racism, many writers noted that while 75 percent of whites had voted for Giuliani, 95 percent of blacks had voted for Dinkins. Racial voting was thus deemed more prevalent among blacks than among whites.

Paulos asserts that the comparison upon which this conclusion is based is shallow, for it ignores usual patterns of party affiliation. Traditionally, New York City blacks vote 80 percent Democratic anyway, he notes. Therefore if 95

percent of them vote Democratic, it means that only 15 percent have shifted parties. Whites, by contrast, traditionally vote Republican at a rate of 50 percent, so if 75 percent of them vote Republican, it means that fully 25 percent of them have engaged in racial favoritism.

But in the end, Paulos' revisionist assessment is unconvincing. After all, if 80 percent of New York City blacks are Democrats, then only 20 out of 100 were in a position in 1993 to favor race above party, and of those 20, some 15—or 75 percent—did so. Among whites, however, the rate was appreciably lower: of the 50 in 100 who do not ordinarily vote Republican, just 25—or 50 percent—did so.

Turning to the affirmative action debate, Paulos tries to illustrate the vexatiousness of hiring by quota. He first

asks the reader to suppose that the workforce of a sizable firm perfectly mirrors the surrounding community: 25 percent black, 75 percent white, and 5 percent gay. Then he hypothesizes that unbeknownst to the firm and everyone else, race and sexual orientation are correlated in the community. That is, the 5 percent statistic holds true only for the population as a whole, not for one race or the other: 2 percent of blacks and 6 percent of whites are gay. If the workforce manifests the same correlation, Paulos warns, members of both races will believe they are observing discrimination. Black homosexuals, under the mistaken impression that they should comprise 5 percent rather than 2 percent of all black workers, will contend that they are underrepresented. White heterosexuals, under the equally mistaken impression that they should comprise 95 percent rather than 94 percent of all white workers, will also complain of bias.

One wonders about an example that assumes, on the one hand, total ignorance of a general correlation between race and sexual preference and yet, on the other, full knowledge of the sexual orientation of everyone in a large workforce. But more significantly, one wonders how the case Paulos has described is even relevant to the affirmative action debate. Opponents of quotas believe strongly that such measures are unfair and unwise. They would be unlikely to buttress their arguments by citing problems in fine-tuning a quota system.

And after many instances of questionable thinking from Paulos, a broader question arises: Who benefits from this book? Arguably, no one. Its readers may divide into two categories: those who are unimpressed and those who are too impressed. Mathematically aware readers may wince at Paulos' capacity for oversimplification and overstatement, while the less "numerate" may leave with a pervasive though unwarranted mistrust, certain that most issues are more complex than media accounts make them appear but fearful that they lack Paulos' skill at penetrating news coverage. Such mistrust, which can easily

lead to cynicism, is hardly productive.

There can be no doubt that Paulos writes beautifully, that he loves mathematical ideas, and that he discusses such ideas with zest. But he would have done a better job of helping people make sense of the statistics they encounter every day if he had shown more discipline and less self-satisfaction—if he had chosen a limited number of themes, thought them through, and used his formidable skills to develop them to the utmost. As it is, this work reads like the transcript of several weeks of table talk. ■

ARNOLD BARNETT, a professor of operations research at MIT's Sloan School of Management, specializes in applied statistics.

BOOKS

THE FRUITS OF ARROGANCE

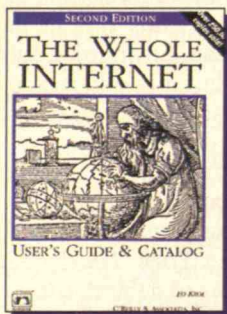
*The Making of a Soviet Scientist:
My Adventures in Nuclear Fusion and Space
from Stalin to Star Wars*
by Roald Sagdeev
John Wiley & Sons, \$24.95

BY LOREN R. GRAHAM

THE life story of Roald Sagdeev, one of the Soviet Union's most distinguished scientists, holds much that attracts attention. For many years he directed the Institute for Space Research of the Soviet Academy of Sciences, where he played the leading role on the Soviet side in the joint U.S.-Soviet *Apollo-Soyuz* mission. He is today distinguished professor of physics at the University of Maryland and director of its East-West Center for Space Science, but he describes his move to the United States as "heart-drain" rather than "brain-drain," since it was prompted by his marriage to Susan Eisenhower,

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granddaughter of the late president. Sagdeev's origins are also worth noting, for they point up one of the most positive characteristics of Soviet science in the immediate postwar period: he came from a Tatar family in a remote Muslim region of the Soviet Union, yet the Soviet educational system recognized his talent and drive and eventually brought him to study with one of the most eminent of Soviet physicists, Lev Landau.

In his autobiography, Sagdeev gives us a sympathetic portrayal of many of his colleagues, especially those he describes as "the keepers of the flame"—people such as Lev Landau and Andrei Sakharov who devoted themselves to science at a time when many others succumbed to political dogma and bureaucratic corruption. Indeed, Sagdeev eventually became a leader of the reformist forces and a close colleague of Andrei Sakharov. In the spring of 1989, when the two of them were candidates for election to the new Soviet legislature as representatives of the Academy of Sciences, they inspired an unprecedented demonstration. The conservative presidium of the academy refused to approve their nominations and relented only after several thousand academy workers gathered in the driveway before the presidium building in Moscow.

Unfortunately, however, Sagdeev's tales of the Soviet scientific intelligentsia also suggest that he has a distorted sense of how important science (and physics, in particular) is to the health of a nation. He writes uncritically of how Soviet scientists, especially physicists, separated themselves from politics, dividing the academic disciplines into the "natural" and "unnatural" sciences and assigning the humanities and social sciences to the latter area. He displays the same attitude toward the jokes in which the brains of physicists were worth 10 times more per pound than those of chemists, 100 times more than those of biologists, and 1,000 times more than those of humanists. Nor does Sagdeev seem to have been disturbed by the songs at parties in which the refrain ran "Only physics makes sense. Every-



thing else is nonsense. Philosophers and philologists are blockheads."

To a certain extent, such arrogance among Soviet scientists was understandable, since politics and the humanities in the Soviet Union were permeated with careerist and ideological considerations. But as has become clear in recent years, the hauteur of scientists helped to create a technocracy that virtually ignored a host of ethical issues. The results included an atomic energy industry without adequate safeguards, culminating in the disaster of Chernobyl, and an incredibly expensive space program at a time when the Soviet people lacked basic consumer goods and adequate health care. We also now know that serious pollution occurred around the space agency's main launching facility, Baikonur.

When the Soviet Union finally collapsed, it was not because of weaknesses in its science or industry. In fact, the Soviets had built a very strong scientific community, and at one time possessed the second-largest industrial economy in the world. Rather, the problem was shortcomings in exactly those areas for which Sagdeev and his colleagues manifested such disdain. Largely through long and thorough neglect of the humani-

ties and social sciences, the Soviets failed to notice that the main goal of any society must be to fulfill basic human needs. One of the most valuable aspects of Sagdeev's memoir is that, without intending to, he helps us understand how this happened—how scientists, so laudable in many ways, nevertheless abetted the country's sorry end. ■

LOREN R. GRAHAM, professor of the history of science at MIT, is the author of *Science in Russia and the Soviet Union: A Short History* (Cambridge University Press, 1993).

BOOKS

INSIDE MICROSOFT

Showstopper! The Breakneck Race to Create Windows NT and the Next Generation at Microsoft

by G. Pascal Zachary
Free Press, \$22.95

BY STEPHEN D. SOLOMON

AT midnight on a Friday in July of 1993, one last software bug still plagued Microsoft's Windows "NT" (for "new technology"). The operating system was set for release the following Monday, but testing had revealed that PageMaker, a widely used desktop publishing program made by Aldus Corp., would not print large documents on it. Desperate, the ranking programmer roused three colleagues from their beds and ordered them back to the office. By 2 a.m., with no fix in sight, he had decided to call the Aldus designer responsible for PageMaker.

The crew of Microsoft programmers thought he lived somewhere nearby in the Seattle area, where Aldus had its offices. "They thought his name might be Ping or Wong or maybe both," writes

G. Pascal Zachary, author of *Showstopper!*. "They first searched for the Pings in the telephone directory for the city of Seattle.... Then they tried the Wongs in the directory. Ken Gregg, a test manager, called a Wong and asked for Ping. He was greeted with a blizzard of Chinese. Wrong Wong, he realized."

When the Microsoft programmers finally reached the right Wong and rewrote the offending lines of code, five years and \$150 million worth of development work came to an end. Perhaps the largest program ever written for PCs, exceeding 5.6 million lines of code, Windows NT was Microsoft's answer to the growing trend toward tying desktop PCs into networks that could exchange files. It was "portable"—that is, unlike existing operating systems, it could be run on any hardware and any type of micro-



processor. At the peak of its development, the project consumed the energy of more than 200 programmers, managers, and technicians. In fact, it nearly consumed the programmers, managers, and technicians themselves, according to *Showstopper!*, Zachary's fly-on-the-wall account.

Zachary, a reporter for the *Wall Street Journal*, takes his book's title from one of the cardinal disasters of programming. The term "showstopper" refers to the type of software bug that makes systems crash, screens freeze, and powerful executives curse like stevedores. Unfortunately, too, committing such an error can be breathtakingly easy. As Zachary shows, software companies operate under different rules of engagement than do other engineering firms. Engineers who build bridges protect against catastrophe with backup systems or with specifications that exceed the anticipated stresses. But software is different, brutally unforgiving of even an errant comma hiding among millions of lines of code.

Worse, software bugs breed, and in their attempt to fix many bugs, NT programmers introduced new generations of errors. "Even seasoned code writers could not dismiss the possibility of being

trapped in something akin to an infinite loop, wherein fixes spawned their own bugs," writes Zachary. "It had happened to others. The history of software was littered with projects, large and small, that had been abandoned in disgust, destroying careers."

David Cutler, the star programmer and manager to whom Microsoft president Bill Gates entrusted NT development, understood the challenges all too well. One of his most important strategies was liberating his group from corporate bureaucracy and all the wasteful friction and heat that it generated. Cutler parceled out tasks to small work groups, and gave programmers considerable freedom to devise their own solutions. Indeed, it was the programmers, not the professional managers, who ran the work groups at Microsoft.

Employees also enjoyed some privileges that would have been impossible at more traditional companies. Two programmers once left for Maui, where they wrote software specifications by their hotel pool while sipping pina colodas. By tapping into the company's e-mail from their laptop computers, they fooled their colleagues into thinking they were still around the office.

Such happy larks, however, proved rare. More typical was a sacrifice-everything philosophy that drove people to place their personal lives in storage for months or years. In fact, *Showstopper!* may be most valuable as a case study in the human losses that sometimes attend projects in corporate America.

Ugly Management

For all his skill in guiding the development of NT, Cutler proved a disagreeable taskmaster, prone to profanities, belittling comments, and temper tantrums. At his fiftieth birthday party, one of his lieutenants arrived with a framed piece of a destroyed office wall—a memento of a recent Cutler blowup. "Cutler could swing from laughter to anger in an instant," writes Zachary. "He shunned levity, advising against playing in the office. He never worried

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about people's feelings. His purpose wasn't to make anyone feel bad; he just wished feelings weren't a concern at all."

Many who had worked with Cutler since the beginning of the project got used to him, but not so the programmers and technicians who swelled the ranks later on. "Most of the new people were afraid of Cutler and his temper tantrums," writes Zachary. "They spoke with him only at their own risk." They did, however, speak openly with Zachary, who relates stories of spouses, lovers, and children cast aside as if with a press of the delete key. One employee slept on a cot in his office for 30 consecutive days, never once going home.

Such an ugly management style raises tough questions. Why was the bullying necessary? How deep was the resentment against Cutler, and didn't it damage the group's work? And why did Microsoft allow the abuses to go on? Yet Zachary never poses those questions, and at one point even seems to excuse Cutler's excesses, writing that "his anger, while sometimes a liability, at least showed how much he cared about his job and the outcome of the project." It appears lost on the author that good management entails more than setting goals and reaching them.

Zachary offers little context or analysis in other areas as well. He loses himself in the day-to-day life of the project and presents little explanation of what was going on in the computer and software industries during the years NT was under development. What were competitors up to? How was the business landscape changing, and how might this have affected the acceptance of NT? Again, Zachary never asks. *Showstopper!* is a rare window into the kind of technology project normally shrouded in secrecy, and Zachary could have used his unusual access to provide more enlightenment. That he did not is the reader's loss. ■

STEPHEN D. SOLOMON, an associate professor of journalism and mass communication at New York University, is a business writer who has served on the staffs of both Inc. and Fortune.

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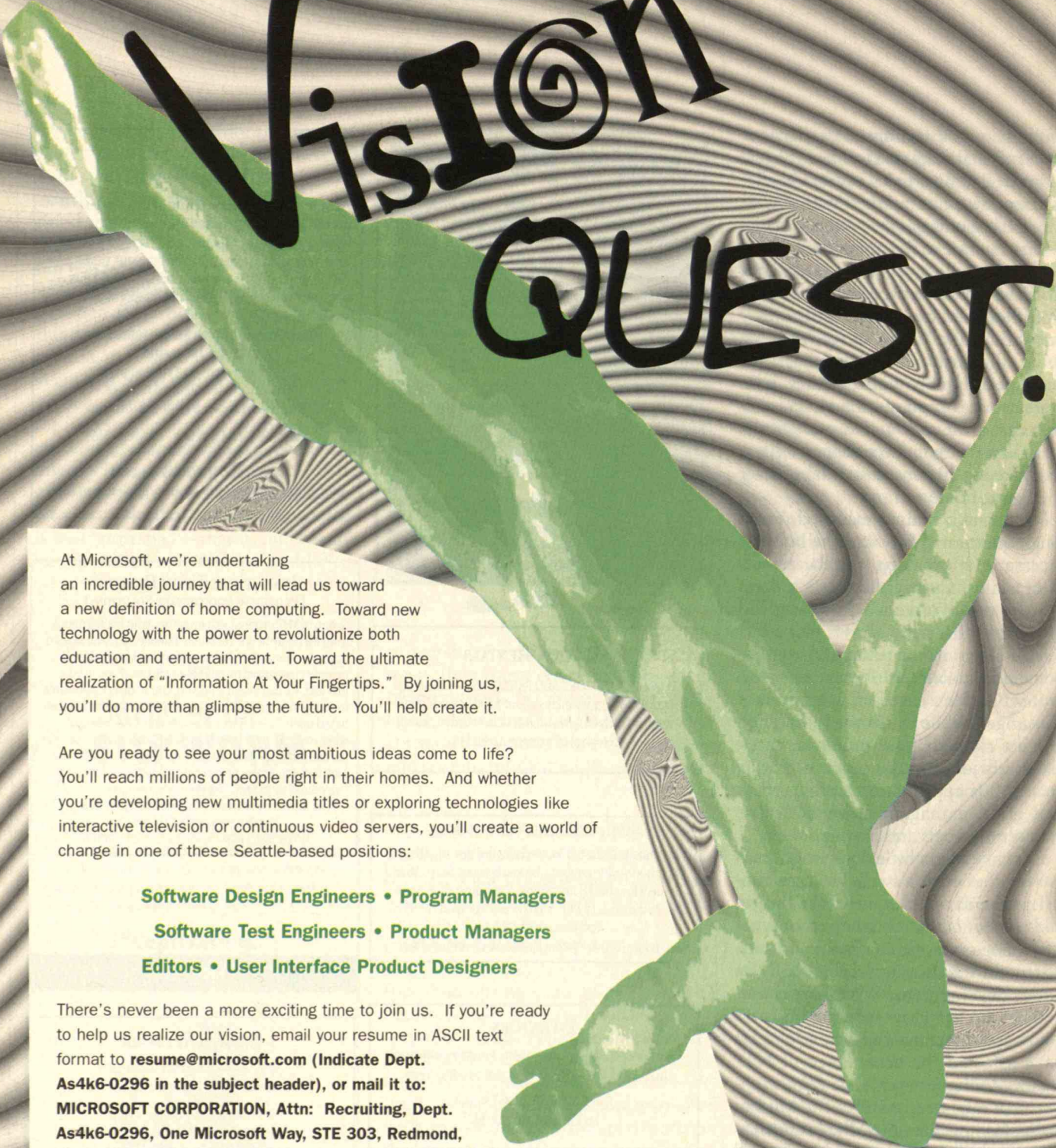
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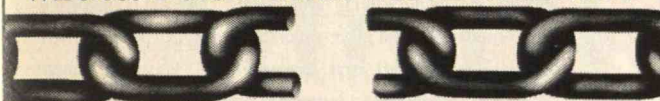
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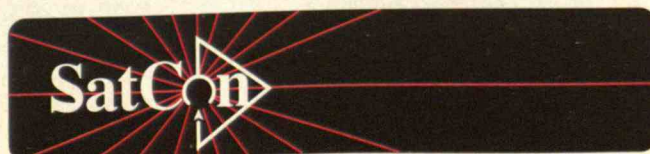
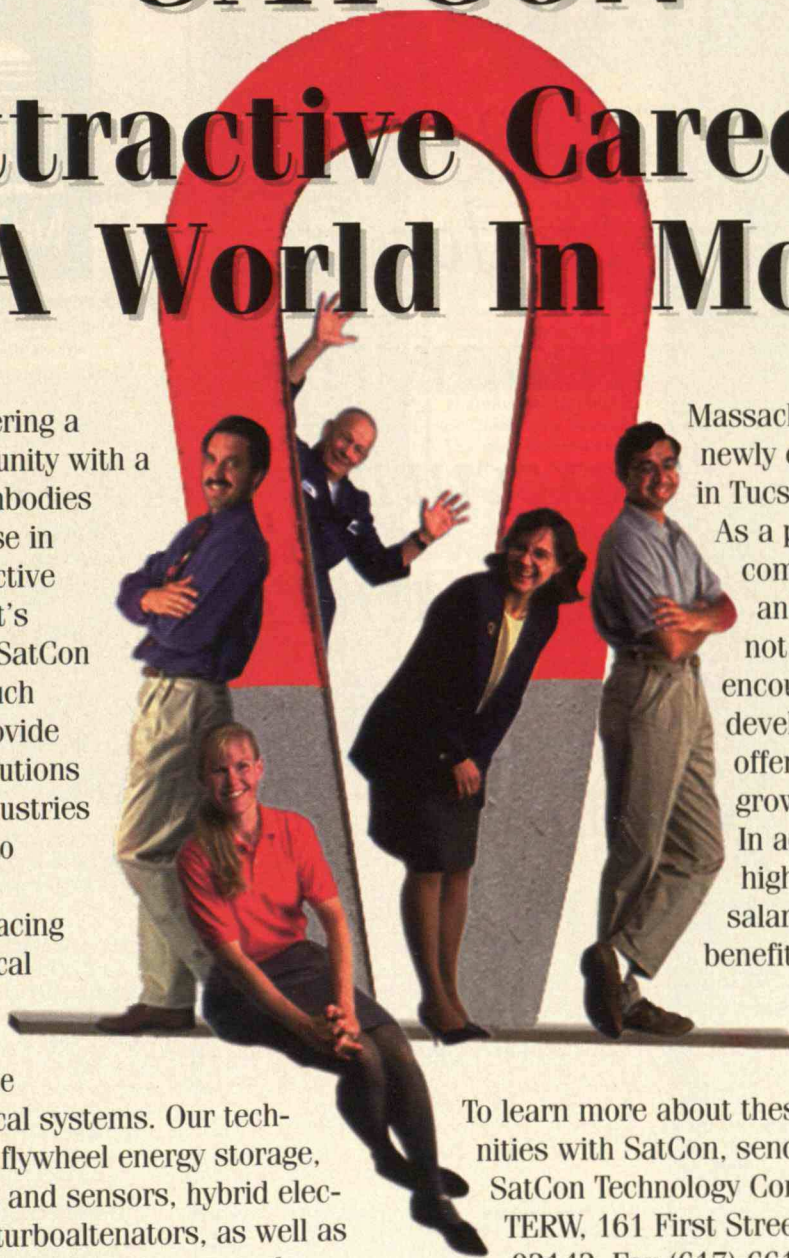
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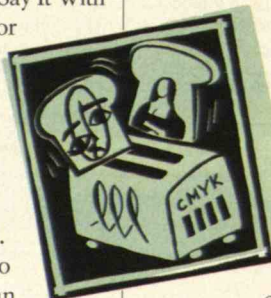
Phenomena

BY DAVID BRITTAN

Hall of Progress

THE recent Winter Consumer Electronics Show in Las Vegas brought yet another crop of smarter, more virtual, and more interactive wares. Most were well picked over by the media—but not all. Here are some deserving products that somehow got lost in the backwaters of the exhibition.

TOASTER/PRINTER • Say It With Toast, a 300-dpi color bubble-jet machine, uses edible dyes to transform an ordinary slice of bread into an eye-popping panorama or a distinctive business card. What better way to say “I love you” than with a plateful of piping-hot Flemish masters. Great for breakfast presentations.



INTERACTIVE SNEAKERS • The Nike Freedom Shoe brings a new dimension of choice to the humdrum act of walking. Select a destination from the programmable LCD menu. Then set the gait—stride, sashay, flounce, toddle, swagger, samba. Your feet do the rest.

BUB • Microsoft's latest “social interface” reprises the gruff but lovable *My Three Sons* character as your on-screen guide to basic computer functions. The ultimate in user-surliness.

VIRTUAL REALTY • The MindSpace architectural simulator headset turns any home into a celebrity dream house. You'll be sipping coffee in your dingy kitchenette—but you'll be

seeing Elvis's immense eat-in kitchen at Graceland. Coming soon: Tara, Windsor Castle, “Wayne Manor.” Includes visors for a family of four plus guest. Shin protectors strongly recommended.

MUSICAL TELLER • ATMs from Diebold combine the convenience of automated banking with the thrill of karaoke. You used to drum on the counter as your transaction was being processed; now you can belt out a Manilow hit, complete with stereo accompaniment and scrolling lyrics. The unit's security camera captures the moment on a VHS videocassette, later mailed with your monthly statement.

PERSONAL ATM • Or skip the bank entirely with the Sony Doughboy, a wallet-sized device that dispenses cash at the touch of a button. Transfer funds between the main compartment and the “secret flap.” Doughboy comes in handy when you're short of cash, but high-priced refill packs may make it a plaything for the rich. Top-grain leather.

SUB-SUBWOOFER • The bone-rattling bass that a subwoofer brings to a sound system feels tame next to the Earthmover sub-subwoofer from Bose, with its frequency range of 0.1–0.5 Hz. The secret is a pair



of boxing-glove-shaped actuators that administer a sharp blow to both ears every 2 to 10 seconds. Worn in place of headphones.

ADAPTIVE TABLEWARE • It's a dinner fork. No, it's a salad fork. Wait, now it's a three-pronged melon fork. It's the new Corning Smart-Fork, the utensil that's right for any occasion. Solid-state sensors detect the course being served, and “smart” materials assume the form that etiquette demands. All you do is stuff your face.



DIGITAL SCAPEGOAT • The Sony Whippingboy accepts blame for your every mistake. “Really, Officer, this is all *my* fault.” “I never should have suggested this shortcut.” “No, please, break *my* kneecaps.” The animated face on this hand-held system displays an ingratiating repertoire of cringes, pouts, and grimaces. Will serve jail time where allowable by law, attend your IRS audit, or sub for Catholics at confession (it even does penance). High-impact polystyrene case withstands throttlings, canings, and small-caliber mob hits.

OPTICAL CHARACTER READER • Minolta unit detects character flaws and makes helpful suggestions for improvement.

PASSENGER FLIGHT SIMULATOR • In “Destination: Newark” (Mac, Windows), you fly business class on a Boeing 757, experiencing all the heart-pumping action of a real commercial flight. Watch cloud cover zoom by, make lightning decisions (chicken or pasta?), unlock the secrets of the in-flight magazine. Better make sure your seat is in the upright position.

PORTABLE SPEAKER PHONE • Why let total strangers hear only one side of your important cell-phone conversations? The Mega-Phone's 12-watt amplified pocket speaker lets you broadcast the whole story as you stroll down the boulevard. Impress passers-by with your handling of “difficult” personalities. Wow them with your snappy comebacks. You know that no one can close a deal the way you can—now the world will know.

TRULY INTERACTIVE TV • With Sony's Toyboy, you write the scripts and control the action. A hollow 25-inch TV set contains hundreds of possible action figures, including Connie Chung, Oprah, and Bub. Bring Connie and Dan together again. Book Leno as a guest on Letterman. Fix Ted Koppel's hair. You always knew there were little people inside your TV set. Now make them do your bidding.



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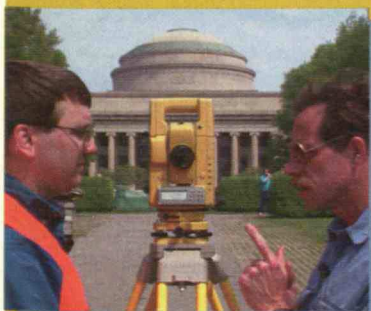
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Humans in Space - The Next Steps: Professor Laurence R. Young—Before the first animals and humans were launched into space, the scientific community expressed understandable caution and ignorance about weightlessness and its affects on space travelers. In a short time, this was replaced by the realization that adapting to weightlessness was easy, except for the nasty issue of space motion sickness. In this fascinating videotape, Professor Young summarizes some of the open problems in long duration human space exploration, and some of the approaches to artificial gravity that might be pursued on earth and in low earth orbit in preparation for the next era in human space exploration.



Measurement: Distance, Velocity and Acceleration: Professor R. John Hansman—MIT's human length standard, Oliver Smoot, reenacts his famous bridge measurement at the National Institute of Standards and Technology (NIST). Professor Hansman also explains measurement using demonstrations videotaped at the top of the MIT Dome, at the MT. Washington Observatory, at the Lincoln Laboratory experimental radar facilities and the MIT Rifle Range.

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